

Empirical predictions of yrast energies in even-even nuclei

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Abstract

The lowest excitation energies of the given multipole J^π state (the J^π yrast energies) are given for even-even nuclei throughout the entire periodic table. The yrast energies were calculated using the recently proposed empirical formula that depends only on the mass number A , and the valence nucleon numbers N_p and N_n . We provide a complete tabulation and plots of the yrast energies calculated using the empirical formula together with the ones measured for the natural parity states up to 10^+ and for the unnatural parity states up to 10^- with the hope of encouraging active study on the possible origin of the relationship between the yrast energies, as revealed by the empirical formula.

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1. Introduction

The exhaustive compilation of experimental results for the reduced electric quadrupole transition probability, $B(E2)$, between the 0^+ ground state and first 2^+ state in even-even nuclei by Raman *et al.* provided a rare opportunity to perform a systematic study of the relevant nuclear properties throughout the periodic table [1]. They have even suggested the ‘global best fit’, $B(E2) = (2.57 \pm 0.45)E^{-1}Z^2A^{2/3}$, to the measured $B(E2)$ values in terms of simply the atomic number Z and mass number A . However,

knowledge of the measured excitation energy E of the first 2^+ state was still required to make acceptable global predictions in terms of just Z and A .

Meanwhile, the valence nucleon numbers N_p and N_n have been used widely to parameterize various nuclear properties phenomenologically. Hamamoto was the first to recognize the utility of the valence nucleon numbers and show that the square root of the ratio of the measured and the single-particle $B(E2)$ values, $[B(E2)_{\text{exp}}/B(E2)_{\text{sp}}]^{1/2}$, is roughly proportional to the product $N_p N_n$ [2]. In addition, Casten noticed that a simple pattern appeared when nuclear data concerning nuclear deformation was plotted as a function of the product $N_p N_n$ and such phenomenon was referred to as the $N_p N_n$ scheme. Indeed, the $N_p N_n$ scheme has been used extensively and successfully for more than two decades to correlate large volumes of data on the collective degrees of freedom in nuclei [3, 4].

Recently, we reported the empirical findings of a simple formula that could reproduce the first 2^+ excitation energy (the 2^+ yrast energy) in even-even nuclei [5]. The idea for the empirical formula was first envisaged by inspecting Figs. I(a), II(a), and III(a) of Ref. [1] where the measured 2^+ yrast energy in 557 even-even nuclei was plotted as function of the mass number A , the atomic number Z , and the neutron number N , respectively. Later, the same empirical formula was shown to be capable of describing the main trends of the yrast energies of not only the electric quadrupole states but also the natural parity even as well as odd multipole states up to 10^+ found in all even-even nuclei [6, 7]. Furthermore, the yrast energies followed the same empirical formula even for unnatural parity states [8].

Thus it is now evident that this empirical formula characterizes the overall shape of the yrast energies for all multipoles, including both natural and unnatural parity states. Once it has been established that there is a universal relationship between the yrast energies, such as our empirical formula, it is natural to imagine that there would be some underlying dynamical origin for such a relationship. Unfortunately, the origin is unclear. This paper provides a complete tabulation and plots of the yrast energies calculated using the empirical formula together with the measured ones for the natural parity states up to 10^+ and also for the unnatural parity states up to 10^- with the hope of soliciting an active study on the possible origins of the relationship between yrast energies.

2. Empirical formula and yrast energy distribution

The empirical formula, mentioned in the previous section, was first introduced to find a simple formula that could reproduce the graph of the 2^+ yrast energies shown in the upper panel of Fig. 1(a) which shows the data quoted from Ref. [1], where the best known values of the 2^+ yrast energies were compiled for even-even nuclei. However, one does not normally attempt to describe any graph with many spikes, such as the one shown in Fig. 1(a), using a formula that depends on only smoothly changing variables. Even after adopting the valence nucleon numbers N_p and N_n as well as the mass number A , it was barely possible to devise an empirical formula that could describe complicated graphs of the 2^+ yrast energies measured from all even-even nuclei throughout the entire periodic table. The valence proton (neutron) number N_p (N_n) of a nucleus with an atomic (neutron) number Z (N) is defined as

$$N_p(N_n) = \begin{cases} Z(N) - N_{c-1} & \text{if } N_{c-1} < Z(N) \leq M_c \\ N_c - Z(N) & \text{if } M_c < Z(N) \leq N_c, \end{cases} \quad (1)$$

where N_c is the magic number for the c -th major shell, and M_c is the average of the two adjacent magic numbers, $(N_{c-1} + N_c)/2$, which corresponds to the number of nucleons contained in the mid-shell nucleus of the c -th major shell. The valence nucleon

numbers N_p and N_n repeat the positive integer numbers from zero whenever the atomic number Z or the neutron number N crosses one of the major shell boundaries.

The original form of the empirical formula first introduced in Ref. [5] for the 2^+ yrast energy in even-even nuclei was written as

$$E_x = \alpha A^{-\gamma} + \beta \left[e^{-\lambda N_p} + e^{-\lambda N_n} \right], \quad (2)$$

where α , γ , β , and λ are four model parameters to be fitted from the data. However, after testing different formulae with several other forms, including a term with the product $N_p N_n$, the following six-parameter form was chosen as the best expression for the yrast energy E_x in even-even nuclei [9]:

$$E_x = \alpha A^{-\gamma} + \beta_p e^{-\lambda_p N_p} + \beta_n e^{-\lambda_n N_n}. \quad (3)$$

Here, the parameters β and λ in Eq. (2) are split into β_p , β_n and λ_p , λ_n , respectively. This considers the fact that protons and neutrons make different contributions to the yrast energy E_x .

The 2^+ yrast energies calculated from Eq. (3) are plotted in the lower panel of Fig. 1(b). We can find a very close similarity between the curves in the upper and lower panels in Fig. 1(a), the data and our calculated results, respectively. (In the electronic version, the color code for an isotopic chain in the upper panel is the same as the color code for the corresponding isotopic chain in the lower panel.) Although it is remarkable that a simple formula, such as Eq. (3), can reproduce the data both qualitatively and quantitatively to some extent, it is better to discuss what it means to claim that there is a certain meaningful relationship between a myriad of data points. This issue is raised because our empirical formula was sometimes critiqued for its use of too many free parameters. However, as a counter example, where no simple relationship can be easily found, consider the same 2^+ yrast energies but measured in odd-odd nuclei, which are plotted in the upper panel of Fig. 1(b). The measured 2^+ yrast energies in odd-odd nuclei were collected from the ENSDF database [10]. The same 2^+ yrast energies, in odd-odd nuclei, calculated using the empirical formula are shown in the lower panel of Fig. 1(b). In contrast to the 2^+ yrast energies in even-even nuclei, a comparison of the graphs shown in the upper and lower panels of Fig. 1(b) suggests that the empirical formula can never represent the 2^+ yrast energy data measured from odd-odd nuclei.

The six model parameters α , γ , β_p , β_n , λ_p , and λ_n of Eq. (3) can be determined easily and unambiguously using the usual least-squares-fitting procedure. The values adopted for these six parameters are listed in Table A together with the total data points N_0 for each multipole state. The values are quoted from Refs. [6] and [7] for the natural parity states and from [8] for the unnatural parity states. The values are also shown in Fig. 2 with solid circles (even multipoles) and solid squares (odd multipoles).

The parameter values listed in Table A were fitted to each multipole separately. However, one can devise a formula that can be used for different multipoles with the same spin dependent parameter values after replacing the four parameters α , γ , λ_p , and λ_n with

$$\alpha = \alpha_0 J^a, \quad \gamma = \gamma_0 J^c, \quad \lambda_p = \frac{\lambda_p^0}{\sqrt{J}} \quad \text{and} \quad \lambda_n = \frac{\lambda_n^0}{\sqrt{J}}, \quad (4)$$

where a and c are additional parameters introduced to give the proper J dependence of α and γ , respectively, and λ_p^0 and λ_n^0 are new J -independent parameters that were fitted in place of λ_p and λ_n , respectively [11]. The spin-dependent empirical formula can now be expressed as follows:

$$E_x = \alpha_0 J^a A^{-\gamma_0 J^c} + \beta_p e^{-\frac{\lambda_p^0 N_p}{\sqrt{J}}} + \beta_n e^{-\frac{\lambda_n^0 N_n}{\sqrt{J}}}. \quad (5)$$

Now, the eight parameters α_0 , a , γ_0 , c , β_p , β_n , λ_p^0 , and λ_n^0 are determined using the yrast energies of all the even or odd multipoles of the natural or unnatural parity states.

The results for the eight parameters in Eq. (5), which are quoted from Ref. [11] (for natural parity states) and Ref. [12] (for unnatural parity states), are listed in Table B, together with the number of total data points N_0 , which were included in the fitting procedure. The original six parameters estimated using the spin dependent formula, Eq. (5), are shown in Fig. 2 with open circles (even multipoles) and open squares (odd multipoles). By comparing the open symbols with the corresponding solid ones in Fig. 2, it is evident that the agreement between the parameters obtained by fitting each multipole separately and those parameters obtained using the spin dependent formula is quite impressive. It was also pointed out that the increase in the χ^2 value after using the spin dependent empirical formula amounts to only $\sim 5\%$ [11]. Therefore, the spin dependent empirical formula, Eq. (5), reproduces the results of the spin independent case, Eq. (3), with fewer parameters.

From the results for the six parameters shown in Fig. 2 and Tables A and Table B, we can make the following observations on the yrast energy distributions. The parameters α and γ , which belong to the mass-dependent term of Eq. (3), show a different characteristic dependence on J according to whether they represent even or odd multipole states of the natural or unnatural parity states. In particular, Table B shows that α has an almost quadratic dependence on J for even multipoles and an almost linear dependence for odd multipoles in the case of the natural parity states. However, in the case of the unnatural parity states, α becomes practically constant over J for both even and odd multipoles.

Of the six parameters, the first two parameters, α and γ , determine the gross behavior of the yrast energy distributions. Therefore, the difference between the values of α and γ determines the sharp distinction in the gross shape of the yrast energy distributions shown in Figs. 3 and 4 between the even and odd multipoles of the natural or unnatural states. For the natural parity states, we show the measured (upper panel) and calculated (lower panel) yrast energies in even-even nuclei for the even multipole states including 2^+ , 4^+ , 6^+ , 8^+ , and 10^+ , in Fig. 3(a), while we also show those for the odd multipole states, including 3^- , 5^- , 7^- , and 9^- in Fig. 3(b). The dipole (1^-) yrast energies are excluded from Fig. 3(b) because they do not follow the common pattern of the other odd multipole cases shown in Fig. 3(b) [7]. Similarly, for the unnatural parity states, we show the yrast energies in even-even nuclei for the even multipole states including 2^- , 4^- , 6^- , 8^- , and 10^- , in Fig. 4(a), whereas we show also those for the odd multipole states, including 1^+ , 3^+ , 5^+ , 7^+ , and 9^+ in Fig. 4(b).

By comparing the graphs shown in Fig. 3(a) and (b), we immediately find for the natural parity states that although the yrast energies are getting larger as the multipole of the state increases for both the even and odd multipole states, the yrast energies of odd multipole states lie significantly closer together than those of the even multipole states. For the unnatural states, however, by comparing the graphs shown in Fig. 4(a) and (b), we find that the overall shapes of the yrast energy distributions of the even and odd multipole states are quite similar. In contrast to the first two parameters, α and γ , the remaining four parameters β_p , β_n , λ_p , and λ_n , which belong to the terms involving the valence nucleon numbers, depend similarly on J regardless of the multipole-parity relations of the states they belong to and determine the detailed shape of the yrast energy distributions within each major shell.

Acknowledgments

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Figures

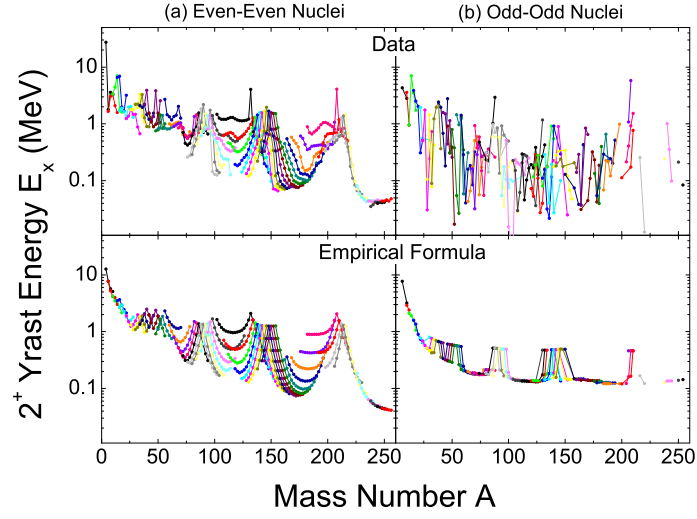


Fig. 1: (Color online) Yrast energies of 2^+ states in (a) even-even (left panels) and (b) odd-odd nuclei (right panels). The data points are connected along the isotopic chains. The upper two panels show the measured 2^+ yrast energies while the lower two panels show those calculated by using the empirical formula. The measured 2^+ yrast energies are quoted from Ref. [1] for even-even nuclei and collected from the ENSDF database for odd-odd nuclei [10].

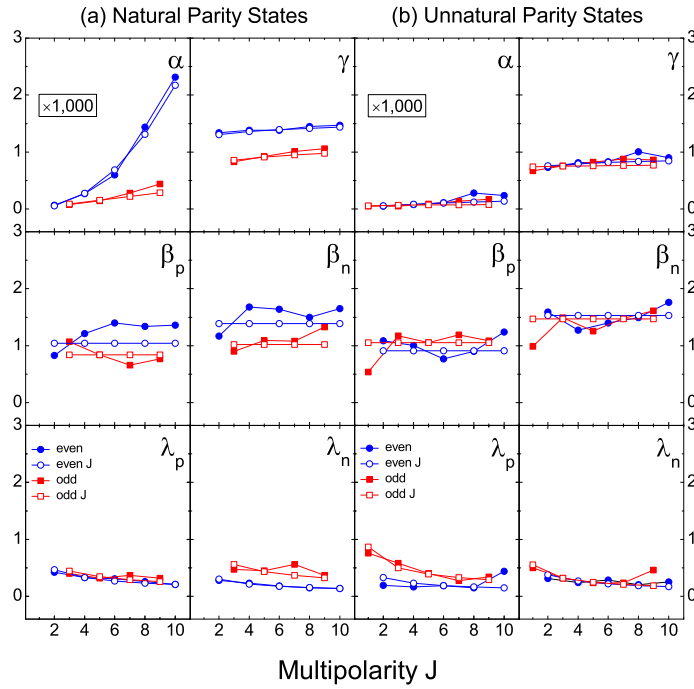


Fig. 2: (Color online) Six parameters that appear in Eq. (3). Solid symbols denote the parameter values determined for each multipoles and open symbols reflect the results obtained by using the spin dependent empirical formula. Circles are for the even multipole states while squares are for the odd multipole states. The parameter values for the natural parity states are quoted from Refs. [6] and [9] and those for the unnatural parity states are quoted from Ref. [8].

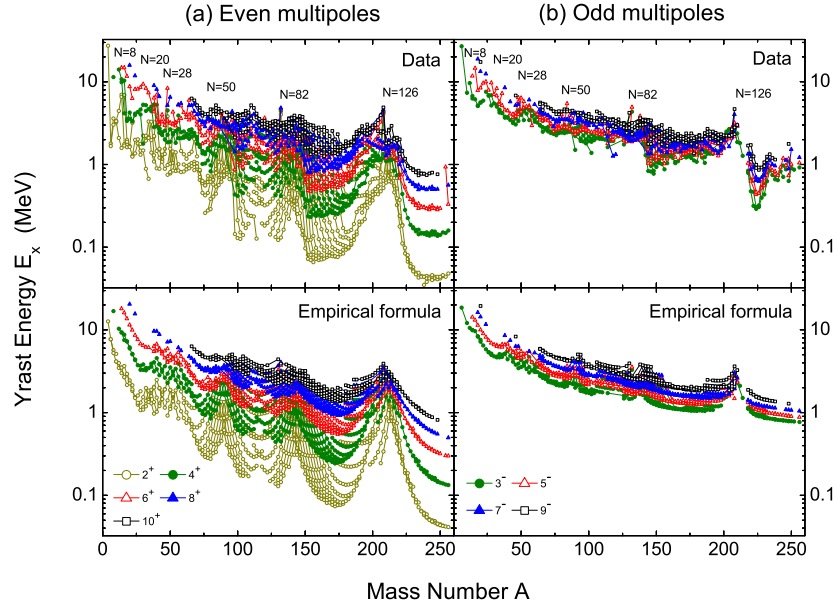


Fig. 3: (Color online) Yrast energies of the natural parity (a) even multipole and (b) odd multipole states in even-even nuclei. The upper two panels show the measured yrast energies while the lower two panels show those calculated by using the empirical formula given by Eq. (3). The measured excitation energies were collected from the ENSDF database [10].

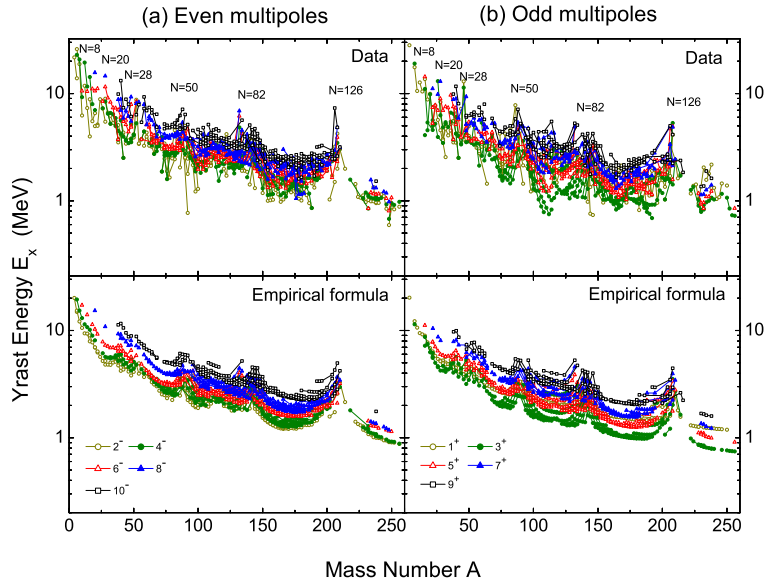


Fig. 4: (Color online) Same as Fig. 3, but for the unnatural parity states. The measured excitation energies were collected from the ENSDF database [10].

Tables

Table A

The values adopted for the six parameters in the empirical formula, Eq. (3), for the yrast energies E_x of the natural parity states including even multipoles (2^+ , 4^+ , 6^+ , 8^+ , and 10^+) and odd multipoles (1^- , 3^- , 5^- , 7^- , and 9^-) and also of the unnatural parity states including even multipoles (2^- , 4^- , 6^- , 8^- , and 10^-) and odd multipoles (1^+ , 3^+ , 5^+ , 7^+ , 9^+ , and 11^+). These values are quoted from Ref. [6] and [7] for the natural parity states and from Ref. [8] for the unnatural parity states. The last column denotes the total number N_0 of the data points for the corresponding multipole state.

J^π	α (MeV)	γ	β_p (MeV)	β_n (MeV)	λ_p	λ_n	N_0
2^+	68	1.34	0.83	1.17	0.42	0.28	557
4^+	268	1.38	1.21	1.68	0.33	0.23	430
6^+	598	1.38	1.40	1.64	0.31	0.18	375
8^+	1,439	1.45	1.34	1.50	0.26	0.15	309
10^+	2,317	1.47	1.36	1.65	0.21	0.14	265
1^-	75	0.83	2.18	2.33	0.57	0.44	196
3^-	77	0.83	1.07	0.90	0.40	0.47	317
5^-	144	0.92	0.84	1.09	0.32	0.45	352
7^-	283	1.01	0.66	1.08	0.37	0.56	315
9^-	442	1.06	0.77	1.33	0.32	0.37	267
2^-	48	0.73	1.09	1.59	0.19	0.31	246
4^-	75	0.81	1.00	1.27	0.17	0.24	253
6^-	108	0.83	0.77	1.40	0.19	0.28	248
8^-	277	1.00	0.90	1.49	0.15	0.20	230
10^-	238	0.90	1.24	1.76	0.44	0.25	199
1^+	47	0.67	0.54	0.99	0.76	0.50	251
3^+	49	0.76	1.17	1.49	0.58	0.32	236
5^+	87	0.82	1.05	1.26	0.40	0.24	250
7^+	139	0.88	1.19	1.48	0.28	0.24	184
9^+	173	0.86	1.09	1.61	0.34	0.46	159

Table B

The values adopted for the eight parameters in the spin dependent empirical formula, Eq. (5), for the yrast energy of the natural parity even and odd multipole states (upper two rows) and of the unnatural parity even and odd multipole states (lower two rows). The values are quoted from Ref. [11] for the natural parity states and from Ref. [12] for the unnatural parity states. The last column denotes the total number N_0 of the data points included in the fitting procedure.

J^π	α_0 (MeV)	a	γ_0	c	β_p (MeV)	β_n (MeV)	λ_p^0	λ_n^0	N_0
Natural Even	11.94	2.26	1.25	0.06	1.04	1.39	0.66	0.43	1936
Natural Odd	28.15	1.05	0.75	0.12	0.84	1.02	0.77	0.97	1447
Unnatural Even	38.48	0.56	0.72	0.07	0.91	1.53	0.46	0.54	1176
Unnatural Odd	53.65	0.16	0.74	0.02	1.06	1.47	0.87	0.56	1197

Explanation of Tables

Table 1. Yrast energies of the natural parity even multipole states in even-even nuclei.

Yrast energies in MeV of the natural parity even multipole states including $J^\pi = 2^+, 4^+, 6^+, 8^+$, and 10^+ in even-even nuclei are given. The first number before the slash is the measured yrast energy and the second number after the slash is the calculated one by using Eq. (3).

Nuclide	Even Z and even N nuclide studied
A	Mass number of the nuclide
N_p	Valence proton number of the nuclide
N_n	Valence neutron number of the nuclide

Table 2. Yrast energies of the natural parity odd multipole states in even-even nuclei.

Same as Table 1 but for the natural parity odd multipole states including $J^\pi = 1^-, 3^-, 5^-, 7^-$, and 9^- .

Table 3. Yrast energies of the unnatural parity even multipole states in even-even nuclei.

Same as Table 1 but for the unnatural parity even multipole states including $J^\pi = 2^-, 4^-, 6^-, 8^-$, and 10^- .

Table 4. Yrast energies of the unnatural parity odd multipole states in even-even nuclei.

Same as Table 1 but for the unnatural parity odd multipole states including $J^\pi = 1^+, 3^+, 5^+, 7^+$, and 9^+ .

Explanation of Graphs

Graph 1. 2^+ yrast energies in even-even nuclei.

(Color online) 2^+ yrast energies in even-even nuclei are plotted against the mass number A in the left two panels and against the product $N_p N_n$ between the valence proton number N_p and the valence neutron number N_n in the right two panels. The upper two panels show the measured yrast energies while the lower two panels show those calculated by the empirical formula, Eq. (3).

Graph 2. 4^+ yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 4^+ yrast energies.

Graph 3. 6^+ yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 6^+ yrast energies.

Graph 4. 8^+ yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 8^+ yrast energies.

Graph 5. 10^+ yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 10^+ yrast energies.

Graph 6. 1^- yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 1^- yrast energies.

Graph 7. 3^- yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 3^- yrast energies.

Graph 8. 5^- yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 5^- yrast energies.

Graph 9. 7^- yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 7^- yrast energies.

Graph 10. 9^- yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 9^- yrast energies.

Graph 11. 2^- yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 2^- yrast energies.

Graph 12. 4^- yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 4^- yrast energies.

Graph 13. 6^- yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 6^- yrast energies.

Graph 14. 8^- yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 8^- yrast energies.

Graph 15. 10^- yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 10^- yrast energies.

Graph 16. 1^+ yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 1^+ yrast energies.

Graph 17. 3^+ yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 3^+ yrast energies.

Graph 18. 5^+ yrast energies in even-even nuclei.

(Color online) Same as Graph 1 but for 5^+ yrast energies.

Graph 19. **7^+ yrast energies in even-even nuclei.**

(Color online) Same as Graph 1 but for 7^+ yrast energies.

Graph 20. **9^+ yrast energies in even-even nuclei.**

(Color online) Same as Graph 1 but for 9^+ yrast energies.

Table 1

Yrast energies of the natural parity even multipole states in even-even nuclei.

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^+$	$J = 4^+$	$J = 6^+$	$J = 8^+$	$J = 10^+$
He	4	0	0	27.42/12.67				
	6	0	2	1.797/7.695				
	8	0	2	3.590/5.713				
	10	0	0	3.240/5.125				
Be	6	2	0	1.670/7.725				
	8	2	2	3.040/5.241	11.40/16.89			
	10	2	2	3.368/4.152				
	12	2	0	2.102/3.976				
	14	2	2	1.590/3.018				
C	10	2	2	3.353/4.152				
	12	2	2	4.438/3.474	14.08/10.37			
	14	2	0	7.012/3.519	10.74/9.329	14.87/18.07		
	16	2	2	1.766/2.691	4.142/7.527			
	18	2	4	1.620/2.162				
O	14	0	2	6.590/3.489	9.915/9.294			
	16	0	0	6.917/3.665	10.36/8.731	14.82/16.08		
	18	0	2	1.982/2.920	3.554/7.236	11.69/13.62		
	20	0	4	1.673/2.446	3.570/6.173			
	22	0	6	3.190/2.135				
Ne	16	2	2	1.690/2.691				
	18	2	0	1.887/2.950	3.376/7.270			
	20	2	2	1.633/2.261	4.247/5.979	8.777/11.48		
	22	2	4	1.274/1.827	3.357/5.059	6.311/9.951	15.87/20.59	
	24	2	6	1.981/1.543	3.962/4.386			
	26	2	4	2.018/1.609				
	28	2	2	1.310/1.813				
Mg	22	4	2	1.246/1.909	3.308/5.148			
	24	4	4	1.368/1.503	4.122/4.331	8.113/8.653	11.86/15.64	
	26	4	6	1.808/1.241	4.318/3.735	8.201/7.633		
	28	4	4	1.473/1.323	4.020/3.691			
	30	4	2	1.482/1.540	1.788/3.837			
	32	4	0	0.885/1.982				
	34	4	2	0.670/1.429				
Si	26	6	4	1.795/1.317				
	28	6	6	1.779/1.071	4.617/3.288	8.543/6.797		
	30	6	4	2.235/1.166	5.280/3.290	9.371/6.491		
	32	6	2	1.941/1.393	5.220/3.472			
	34	6	0	3.327/1.843				
	36	6	2	1.399/1.297				
	38	6	4	1.084/0.971				
S	30	4	6	2.210/1.090				
	32	4	4	2.230/1.194	4.458/3.237	8.345/6.212		
	34	4	2	2.127/1.429	4.688/3.448	7.392/6.156		
	36	4	0	3.290/1.886	5.012/3.911			
	38	4	2	1.292/1.345	2.825/3.154	4.336/5.500		
	40	4	4	0.900/1.024				
	42	4	2	0.890/1.280				
Ar	44	4	0	1.315/1.754				
	34	2	4	2.090/1.346				
	36	2	2	1.970/1.588	4.414/3.594			
	38	2	0	2.167/2.051	5.349/4.076	6.408/6.344	8.998/9.663	
	40	2	2	1.460/1.514	2.892/3.335	3.464/5.578		
	42	2	4	1.208/1.197	2.415/2.837			
	44	2	2	1.144/1.456				
Ca	46	2	0	1.550/1.933				
	38	0	2	2.206/2.021				

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(Table I. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^+$	$J = 4^+$	$J = 6^+$	$J = 8^+$	$J = 10^+$
	40	0	0	3.904/2.488	5.278/4.540	6.930/6.721	8.098/9.678	
	42	0	2	1.524/1.955	2.752/3.813	3.189/5.986	6.635/8.822	
	44	0	4	1.157/1.641	2.283/3.326	3.285/5.426		
	46	0	2	1.346/1.903	2.574/3.631	2.973/5.580		
	48	0	0	3.831/2.382	4.503/4.173	8.388/5.902		
	50	0	2	1.026/1.860				
	52	0	4	2.563/1.555				
Ti	42	2	0	1.554/1.985	2.676/3.848	3.043/5.835		
	44	2	2	1.082/1.456	2.454/3.132	4.015/5.125		
	46	2	4	0.889/1.144	2.009/2.655	3.299/4.587		
	48	2	2	0.983/1.409	2.295/2.969	3.333/4.760	5.197/7.158	
	50	2	0	1.553/1.890	2.674/3.518	3.198/5.099	6.539/7.245	
	52	2	2	1.049/1.370	2.317/2.834	3.027/4.460		
Cr	48	4	4	0.752/0.918	1.858/2.275	3.445/4.066		
	50	4	2	0.783/1.185	1.881/2.596	3.163/4.255		
	52	4	0	1.434/1.668	2.369/3.152	3.113/4.608		
	54	4	2	0.834/1.149	1.823/2.474	3.222/3.982		
	56	4	4	1.006/0.847	2.681/2.030			
Fe	50	2	4	0.810/1.102				
	52	2	2	0.849/1.370	2.385/2.834	4.329/4.460		
	54	2	0	1.408/1.855	2.538/3.396	2.949/4.826		
	56	2	2	0.846/1.337	2.085/2.723	3.388/4.211	5.255/6.106	
	58	2	4	0.810/1.036	2.076/2.283	3.596/3.756	5.503/5.610	
	60	2	6	0.823/0.860	2.114/1.991			
	62	2	8	0.876/0.754	2.175/1.793			
Ni	56	0	0	2.700/2.311	3.923/3.927	5.315/5.354		
	58	0	2	1.454/1.795	2.459/3.258	5.122/4.749		
	60	0	4	1.332/1.495	2.505/2.822	4.265/4.302		
	62	0	6	1.172/1.319	2.336/2.534	4.018/3.968		
	64	0	8	1.345/1.214	2.609/2.339	6.030/3.713		
	66	0	10	1.425/1.150	2.670/2.205			
	68	0	10	2.033/1.141				
	70	0	8	1.259/1.185				
Zn	60	2	2	1.004/1.310	2.193/2.629			
	62	2	4	0.954/1.011	2.186/2.196	3.707/3.562		
	64	2	6	0.991/0.836	2.306/1.910	3.993/3.234		
	66	2	8	1.039/0.732	2.451/1.719	4.182/2.986	5.207/4.557	6.292/6.332
	68	2	10	1.077/0.669	2.417/1.587	3.687/2.794	4.396/4.299	
	70	2	10	0.884/0.660	1.786/1.556			
	72	2	8	0.652/0.705	2.658/1.625			
	74	2	6	0.605/0.790				
	76	2	4	0.598/0.946				
	78	2	2	0.729/1.226				
Ge	64	4	4	0.901/0.796	2.053/1.855	3.467/3.128	5.181/4.756	
	66	4	6	0.957/0.622	2.174/1.572	3.655/2.806		
	68	4	8	1.015/0.519	2.268/1.383	3.696/2.564	5.366/4.094	5.962/5.815
	70	4	10	1.039/0.456	2.153/1.254	3.297/2.377		
	72	4	10	0.834/0.448	1.728/1.225	2.772/2.312	4.077/3.724	4.820/5.305
	74	4	8	0.595/0.493	1.463/1.296	3.059/2.369		
	76	4	6	0.562/0.579	1.410/1.426			
	78	4	4	0.619/0.736	1.570/1.649	3.287/2.668		
	80	4	2	0.659/1.016	1.742/2.018			
	82	4	0	1.348/1.511				
Se	68	6	6	0.854/0.524				
	70	6	8	0.944/0.422	2.037/1.196	3.001/2.307	4.035/3.771	5.204/5.418
	72	6	10	0.862/0.360	1.636/1.068	2.466/2.125	3.424/3.532	4.504/5.104
	74	6	10	0.634/0.352	1.363/1.041	2.231/2.064	3.198/3.419	4.256/4.934
	76	6	8	0.559/0.398	1.330/1.114	2.262/2.125	3.269/3.430	
	78	6	6	0.613/0.484	1.502/1.246	2.546/2.240	3.585/3.488	
	80	6	4	0.666/0.641	1.701/1.470	2.825/2.431		
	82	6	2	0.654/0.921	1.735/1.840			

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(Table I. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^+$	$J = 4^+$	$J = 6^+$	$J = 8^+$	$J = 10^+$
Kr	84	6	0	1.454/1.417	4.442/2.440			
	86	6	2	0.704/0.910				
	72	8	8	0.709/0.375				
	74	8	10	0.455/0.314	1.014/0.961	1.783/1.963	3.367/3.305	3.896/4.802
	76	8	10	0.423/0.306	1.034/0.935	1.859/1.906	2.879/3.198	4.067/4.642
	78	8	8	0.455/0.353	1.119/1.009	1.977/1.970	3.770/3.216	4.105/4.625
	80	8	6	0.616/0.440	1.436/1.143	2.391/2.089	3.409/3.280	4.647/4.659
	82	8	4	0.776/0.597	1.820/1.368	2.919/2.282	3.461/3.406	4.609/4.757
	84	8	2	0.881/0.878	2.097/1.739	3.172/2.584	3.235/3.611	5.203/4.938
	86	8	0	1.564/1.374	2.249/2.340			
	88	8	2	0.775/0.867	1.643/1.703			
	90	8	4	0.707/0.575				
	92	8	6	0.769/0.407				
	94	8	8	0.665/0.309				
Sr	76	10	10	0.260/0.290				
	78	10	10	0.278/0.283				
	80	10	8	0.385/0.330	0.980/0.945	1.763/1.866	2.700/3.054	3.765/4.398
	82	10	6	0.573/0.417	1.328/1.080	2.229/1.987	3.242/3.124	4.423/4.440
	84	10	4	0.793/0.575	1.767/1.307	2.808/2.184	3.332/3.255	4.447/4.546
	86	10	2	1.076/0.856	2.229/1.679	2.856/2.487	2.955/3.465	4.708/4.734
	88	10	0	1.836/1.352	4.227/2.280	4.171/2.943		
	90	10	2	0.831/0.845	1.655/1.644			
	92	10	4	0.814/0.554				
	94	10	6	0.836/0.386				
	96	10	8	0.814/0.288				
	98	10	10	0.144/0.230	0.433/0.692	0.867/1.403	1.433/2.299	2.123/3.314
	100	10	12	0.129/0.196	0.417/0.617			
	102	10	14	0.126/0.175				
Zr	80	10	10	0.289/0.276	0.827/0.847			
	82	10	8	0.407/0.323				
	84	10	6	0.540/0.411	1.263/1.060	2.136/1.942	3.088/3.041	4.067/4.316
	86	10	4	0.751/0.569	1.666/1.288	2.669/2.141	3.298/3.177	4.327/4.429
	88	10	2	1.057/0.850	2.139/1.661	2.810/2.447	2.887/3.391	4.413/4.624
	90	10	0	2.186/1.347	3.076/2.263	3.448/2.905	3.589/3.710	
	92	10	2	0.934/0.840	1.495/1.628	2.957/2.374	3.309/3.255	4.297/4.421
	94	10	4	0.918/0.549	1.469/1.221			
	96	10	6	1.750/0.381	2.750/0.960	3.482/1.720	4.388/2.631	
	98	10	8	1.222/0.284	1.843/0.790	2.491/1.521	3.217/2.416	3.986/3.445
	100	10	10	0.212/0.226	0.564/0.679	1.062/1.374	1.676/2.245	
	102	10	12	0.151/0.192	0.478/0.604	0.965/1.264	1.546/2.107	
	104	10	14	0.140/0.171	0.452/0.553	0.926/1.180	1.551/1.994	
Mo	84	8	8	0.443/0.334				
	86	8	6	0.566/0.422				
	88	8	4	0.740/0.580				
	90	8	2	0.947/0.862	2.002/1.686	2.812/2.464	2.875/3.389	
	92	8	0	1.509/1.359	2.282/2.289	2.612/2.924	2.760/3.711	
	94	8	2	0.871/0.852	1.573/1.654	2.423/2.394	2.955/3.260	3.897/4.414
	96	8	4	0.778/0.561	1.628/1.249	2.440/2.015	2.978/2.912	
	98	8	6	0.787/0.394	1.510/0.988	2.343/1.743	3.271/2.642	
	100	8	8	0.535/0.296	1.136/0.819	1.846/1.545	2.626/2.430	3.365/3.452
	102	8	10	0.296/0.239	0.743/0.708	1.327/1.400	2.018/2.262	2.418/3.244
	104	8	12	0.192/0.205	0.560/0.634	1.079/1.291	1.721/2.126	2.455/3.072
	106	8	14	0.171/0.184	0.522/0.583	1.033/1.208	1.668/2.015	2.472/2.928
	108	8	16	0.192/0.171				
Ru	88	6	6	0.616/0.454				
	90	6	4	0.738/0.613				
	92	6	2	0.864/0.895	1.854/1.750	2.671/2.528	2.833/3.437	3.637/4.640
	94	6	0	1.430/1.392	2.186/2.354	2.498/2.990	2.644/3.763	3.991/4.949
	96	6	2	0.832/0.886	1.518/1.720	2.891/2.462	2.950/3.314	3.816/4.457
	98	6	4	0.652/0.595	1.397/1.316	2.222/2.085	3.126/2.970	4.000/4.069
	100	6	6	0.539/0.428	1.226/1.056	2.076/1.814	3.062/2.703	4.085/3.758
	102	6	8	0.475/0.330	1.106/0.887	1.873/1.618	2.704/2.493	3.432/3.508
	104	6	10	0.358/0.273	0.888/0.777			

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(Table I. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^+$	$J = 4^+$	$J = 6^+$	$J = 8^+$	$J = 10^+$
	106	6	12	0.270/0.240	0.714/0.703	1.295/1.366	1.973/2.194	
	108	6	14	0.242/0.219	0.665/0.653	1.218/1.285	1.919/2.085	2.717/2.994
	110	6	16	0.240/0.206	0.663/0.618	1.239/1.221		
	112	6	14	0.236/0.213	0.645/0.633			
	114	6	12	0.127/0.227				
Pd	94	4	2	0.814/0.978				
	96	4	0	1.415/1.476	2.099/2.496	2.424/3.145	2.530/3.895	3.783/5.062
	98	4	2	0.863/0.970	1.541/1.863	2.112/2.618	2.773/3.450	3.644/4.574
	100	4	4	0.665/0.679	1.416/1.459	2.056/2.243	2.988/3.108	3.869/4.190
	102	4	6	0.556/0.512	1.276/1.199	2.111/1.974	3.013/2.843	3.992/3.883
	104	4	8	0.555/0.415	1.323/1.031	2.249/1.778	3.220/2.636	4.023/3.637
	106	4	10	0.511/0.358	1.229/0.921	2.076/1.635	2.962/2.473	3.948/3.436
	108	4	12	0.433/0.324	1.048/0.848	1.771/1.529	2.548/2.341	3.350/3.270
	110	4	14	0.373/0.304	0.920/0.799	1.573/1.448	2.296/2.235	
	112	4	16	0.348/0.291	0.883/0.764	1.551/1.386		
	114	4	14	0.332/0.298	0.852/0.779	1.500/1.405		
	116	4	12	0.340/0.312	0.879/0.809	1.560/1.441		
	118	4	10	0.378/0.340				
Cd	98	2	0	1.394/1.675				
	100	2	2	1.004/1.169	1.799/2.152	2.251/2.937	2.547/3.719	
	102	2	4	0.776/0.879	1.637/1.748	2.230/2.563	2.718/3.380	3.908/4.420
	104	2	6	0.658/0.712	1.492/1.489	2.114/2.295	2.902/3.117	4.100/4.117
	106	2	8	0.632/0.615	1.493/1.322	2.491/2.101	3.044/2.913	4.436/3.874
	108	2	10	0.632/0.558	1.508/1.213	2.541/1.959	3.110/2.751	4.152/3.676
	110	2	12	0.657/0.525	1.542/1.140	2.479/1.854	3.275/2.622	3.611/3.513
	112	2	14	0.617/0.504	1.415/1.091	2.167/1.774	2.880/2.517	
	114	2	16	0.558/0.491	1.283/1.057	1.991/1.713	2.670/2.430	
	116	2	14	0.513/0.499	1.219/1.072	2.026/1.732		
	118	2	12	0.487/0.513	1.164/1.102	1.935/1.769	2.590/2.469	3.017/3.287
	120	2	10	0.505/0.541	1.203/1.156			
	122	2	8	0.569/0.592	1.329/1.246	2.178/1.932	2.823/2.606	
	124	2	6	0.613/0.683				
	126	2	4	0.652/0.845				
Sn	102	0	2	1.472/1.637				
	104	0	4	1.260/1.347	1.941/2.321	2.255/3.183	3.437/3.874	3.977/4.814
	106	0	6	1.207/1.180	2.017/2.062	2.321/2.916	3.476/3.614	4.128/4.514
	108	0	8	1.206/1.083	2.111/1.896	2.365/2.723	3.561/3.412	4.256/4.274
	110	0	10	1.211/1.027	2.196/1.787	2.756/2.582	3.814/3.252	5.229/4.079
	112	0	12	1.256/0.993			4.077/3.125	4.819/3.919
	114	0	14	1.299/0.973	2.187/1.666	3.148/2.400	3.870/3.021	4.139/3.786
	116	0	16	1.293/0.960	2.390/1.632	3.033/2.339	3.257/2.936	3.547/3.674
	118	0	14	1.229/0.968	2.280/1.648	2.999/2.359	2.889/2.948	3.108/3.678
	120	0	12	1.171/0.983	2.194/1.679	3.664/2.397	2.694/2.978	
	122	0	10	1.140/1.011	2.142/1.732	2.555/2.461	2.690/3.032	2.780/3.753
	124	0	8	1.131/1.062	2.101/1.823	3.011/2.561	2.446/3.118	
	126	0	6	1.141/1.153	2.049/1.971			
	128	0	4	1.168/1.314	2.000/2.211			
	130	0	2	1.221/1.599	1.995/2.595	2.256/3.268	2.338/3.689	2.434/4.416
	132	0	0	4.041/2.098	4.415/3.208	4.714/3.749	4.847/4.051	
	134	0	2	0.725/1.595				
Te	108	2	6	0.625/0.705				
	110	2	8	0.657/0.609				
	112	2	10	0.689/0.552				
	114	2	12	0.708/0.519	1.484/1.120	2.217/1.810	3.089/2.542	3.723/3.395
	116	2	14	0.678/0.499	1.360/1.072	2.003/1.732	2.774/2.441	3.576/3.265
	118	2	16	0.605/0.486	1.206/1.038	1.820/1.672	2.573/2.357	3.359/3.155
	120	2	14	0.560/0.493	1.161/1.055	1.776/1.693	2.652/2.371	3.364/3.161
	122	2	12	0.564/0.508	1.181/1.086	1.751/1.732	2.669/2.402	3.210/3.187
	124	2	10	0.602/0.537	1.248/1.140	1.746/1.797	2.664/2.457	3.154/3.239
	126	2	8	0.666/0.588	1.361/1.231	1.776/1.897	2.765/2.544	2.974/3.326
	128	2	6	0.743/0.679	1.497/1.379	1.811/2.049		
	130	2	4	0.839/0.841	1.633/1.619	1.815/2.275	3.287/2.858	
	132	2	2	0.973/1.125	1.670/2.003	1.774/2.606	2.700/3.119	2.701/3.909
	134	2	0	1.279/1.625	1.576/2.616	1.692/3.087		

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(Table I. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^+$	$J = 4^+$	$J = 6^+$	$J = 8^+$	$J = 10^+$
Xe	136	2	2	0.605/1.121	1.029/1.991	1.381/2.577	2.130/3.067	2.789/3.833
	138	2	4	0.443/0.833				
	112	4	8	0.466/0.402				
	114	4	10	0.449/0.346	1.068/0.880	1.786/1.544	2.478/2.306	
	116	4	12	0.393/0.312	0.917/0.809	1.532/1.441	2.210/2.182	2.961/3.033
	118	4	14	0.337/0.292	0.810/0.761	1.396/1.364	2.073/2.082	2.816/2.905
	120	4	16	0.322/0.280	0.795/0.728	1.397/1.305	2.098/2.000	2.872/2.797
	122	4	14	0.331/0.287	0.828/0.744	1.466/1.327	2.217/2.015	3.039/2.805
	124	4	12	0.354/0.302	0.879/0.776	1.548/1.367	2.331/2.047	3.171/2.834
	126	4	10	0.388/0.331	0.941/0.830	1.635/1.432	2.435/2.104	3.314/2.888
	128	4	8	0.442/0.382	1.033/0.921	1.737/1.533	2.521/2.192	3.363/2.976
	130	4	6	0.536/0.473	1.204/1.070	1.944/1.686	2.696/2.321	2.972/3.108
	132	4	4	0.667/0.635	1.440/1.310	2.111/1.912		
	134	4	2	0.847/0.920	1.731/1.695			
	136	4	0	1.313/1.419	1.694/2.308	1.891/2.725		
	138	4	2	0.588/0.916	1.072/1.682			
	140	4	4	0.376/0.627	0.834/1.286			
	142	4	6	0.287/0.462	0.690/1.033	1.181/1.603	1.732/2.173	2.342/2.888
	144	4	8	0.252/0.367				
Ba	118	6	12	0.194/0.222				
	120	6	14	0.183/0.202	0.541/0.596	1.038/1.158		
	122	6	16	0.196/0.189	0.570/0.563	1.083/1.100	1.704/1.775	2.398/2.547
	124	6	14	0.229/0.197	0.650/0.580	1.223/1.122	1.923/1.791	2.687/2.557
	126	6	12	0.256/0.212	0.711/0.612	1.332/1.163	2.089/1.825	2.942/2.587
	128	6	10	0.284/0.241	0.763/0.667	1.406/1.228	2.188/1.882	3.082/2.643
	130	6	8	0.357/0.292	0.901/0.758	1.592/1.330	2.395/1.971	3.259/2.733
	132	6	6	0.464/0.383	1.127/0.907	1.932/1.484	2.800/2.102	3.116/2.867
	134	6	4	0.604/0.545	1.400/1.148	2.211/1.710	2.835/2.290	2.956/3.058
	136	6	2	0.818/0.830	1.866/1.532	2.207/2.042		
	138	6	0	1.435/1.330	1.898/2.146	2.090/2.524	3.183/2.917	3.622/3.693
	140	6	2	0.602/0.826	1.130/1.520			
	142	6	4	0.359/0.538	0.834/1.124	1.466/1.657		
	144	6	6	0.199/0.372	0.530/0.871	0.961/1.403	1.471/1.959	2.044/2.654
Ce	146	6	8	0.181/0.277	0.513/0.710	0.958/1.223	1.482/1.780	2.052/2.449
	148	6	10	0.141/0.222	0.423/0.607			
	124	8	16	0.142/0.149				
	126	8	14	0.169/0.157	0.518/0.492	1.014/1.005	1.625/1.646	2.321/2.380
	128	8	12	0.207/0.172	0.606/0.524	1.157/1.046	1.819/1.681	2.531/2.412
	130	8	10	0.253/0.200	0.710/0.579	1.324/1.112	2.052/1.740	2.808/2.469
	132	8	8	0.325/0.252	0.859/0.671	1.542/1.214	2.330/1.830	3.158/2.561
	134	8	6	0.409/0.343	1.048/0.820	1.863/1.368	2.811/1.962	3.208/2.696
	136	8	4	0.552/0.505	1.314/1.061	2.214/1.596	2.955/2.150	3.095/2.889
	138	8	2	0.788/0.790	1.826/1.446	2.293/1.928	3.108/2.414	3.539/3.157
	140	8	0	1.596/1.290	2.083/2.059	2.107/2.411	3.512/2.779	3.715/3.526
	142	8	2	0.641/0.786	1.742/1.434			
	144	8	4	0.397/0.498	0.938/1.037			
	146	8	6	0.258/0.333	0.668/0.785	1.171/1.291	1.737/1.823	2.352/2.491
Nd	148	8	8	0.158/0.238	0.453/0.624	1.292/1.645	1.792/2.287	
	150	8	10	0.097/0.183	0.306/0.521	0.606/0.982	0.983/1.508	
	152	8	12	0.081/0.151				
	128	10	14	0.133/0.138	0.424/0.443	0.847/0.934	1.377/1.549	1.986/2.250
	130	10	12	0.158/0.154	0.483/0.475	0.938/0.976	1.485/1.585	2.099/2.283
	132	10	10	0.212/0.182	0.609/0.531	1.131/1.043	1.710/1.645	2.309/2.342
	134	10	8	0.294/0.234	0.788/0.622	1.420/1.146	2.126/1.736	2.816/2.435
	136	10	6	0.373/0.325	0.976/0.772	1.746/1.300	2.632/1.869	3.278/2.572
	138	10	4	0.520/0.487	1.249/1.013	2.134/1.528	3.107/2.058	3.173/2.766
	140	10	2	0.773/0.772	1.801/1.398	2.366/1.861		3.621/3.036
	142	10	0	1.575/1.272	2.101/2.012	2.209/2.344	3.453/2.689	3.925/3.405
	144	10	2	0.696/0.768	1.314/1.387	1.791/1.836	2.709/2.278	3.530/2.970
	146	10	4	0.453/0.480	1.043/0.990	1.780/1.478	2.474/1.969	3.247/2.634
	148	10	6	0.301/0.315	0.752/0.738	1.279/1.225	1.857/1.735	2.472/2.374
	150	10	8	0.130/0.220	0.381/0.578	0.720/1.046	1.129/1.557	1.598/2.171
	152	10	10	0.072/0.165	0.236/0.474	0.484/0.917	0.810/1.421	
	154	10	12	0.070/0.133	0.233/0.408	0.476/0.825	0.805/1.316	

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(Table I. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^+$	$J = 4^+$	$J = 6^+$	$J = 8^+$	$J = 10^+$
Sm	156	10	14	0.066/0.114				
	130	12	14	0.122/0.129				
	132	12	12	0.131/0.144	0.417/0.447			
	134	12	10	0.163/0.173				
	136	12	8	0.254/0.225	0.686/0.595	1.221/1.103	1.798/1.671	2.414/2.341
	138	12	6	0.346/0.316	0.890/0.744	1.576/1.257	2.351/1.804	2.903/2.479
	140	12	4	0.530/0.478	1.245/0.985	2.081/1.486	2.969/1.994	3.172/2.674
	142	12	2	0.768/0.763	1.791/1.371	2.420/1.819	3.326/2.260	3.661/2.945
	144	12	0	1.660/1.263	2.190/1.985	2.323/2.302		
	146	12	2	0.747/0.760	1.381/1.360	1.811/1.795	2.737/2.217	3.774/2.882
	148	12	4	0.550/0.472	1.180/0.964	1.905/1.437	2.544/1.908	3.234/2.547
	150	12	6	0.333/0.306	0.773/0.712	1.278/1.185	1.836/1.675	2.433/2.287
	152	12	8	0.121/0.211	0.366/0.551	0.706/1.006	1.125/1.498	1.609/2.085
	154	12	10	0.081/0.157	0.266/0.448	0.543/0.878	0.902/1.362	1.332/1.926
	156	12	12	0.075/0.125	0.249/0.382	0.517/0.786		
	158	12	14	0.072/0.106	0.240/0.338	0.498/0.719	0.844/1.176	
	160	12	16	0.070/0.095				
Gd	138	14	8	0.220/0.220	0.605/0.577	1.093/1.073	1.649/1.622	2.265/2.267
	140	14	6	0.328/0.311	0.836/0.727	1.464/1.229	2.139/1.757	2.796/2.406
	142	14	4	0.515/0.473	1.209/0.969	1.964/1.457	2.758/1.948	3.137/2.603
	144	14	2	0.743/0.758	1.744/1.354	2.354/1.791		3.433/2.875
	146	14	0	1.971/1.258	2.611/1.968	3.456/2.275	3.779/2.581	3.864/3.247
	148	14	2	0.784/0.755	1.416/1.344	1.811/1.768	2.693/2.172	3.757/2.814
	150	14	4	0.638/0.467	1.288/0.948	1.936/1.411	2.554/1.864	3.288/2.480
	152	14	6	0.344/0.302	0.755/0.696	1.227/1.158	1.746/1.632	2.300/2.222
	154	14	8	0.123/0.207	0.371/0.535	0.717/0.980	1.144/1.455	1.637/2.020
	156	14	10	0.088/0.152	0.288/0.433	0.584/0.852	0.965/1.320	1.416/1.862
	158	14	12	0.079/0.120	0.261/0.366	0.538/0.760	0.904/1.216	1.350/1.737
	160	14	14	0.075/0.102	0.248/0.323	0.514/0.694	0.870/1.135	
	162	14	16	0.071/0.090	0.237/0.294	0.484/0.644		
Dy	142	16	6	0.315/0.308	0.798/0.716	1.387/1.207	2.010/1.720	
	144	16	4	0.492/0.470	1.165/0.957	1.916/1.437		
	146	16	2	0.682/0.755	1.608/1.343	2.636/1.771	2.988/2.178	2.935/2.819
	148	16	0	1.677/1.255	2.426/1.957	2.731/2.255	2.832/2.547	2.919/3.192
	150	16	2	0.803/0.752	1.457/1.333	1.851/1.748	2.402/2.138	3.026/2.760
	152	16	4	0.613/0.464	1.260/0.937	1.944/1.391	2.437/1.831	3.084/2.427
	154	16	6	0.334/0.299	0.747/0.686	1.224/1.140	1.747/1.599	2.304/2.170
	156	16	8	0.137/0.204	0.404/0.525	0.770/0.961	1.215/1.423	1.725/1.969
	158	16	10	0.098/0.150	0.317/0.422	0.637/0.834	1.043/1.289	1.520/1.812
	160	16	12	0.086/0.118	0.283/0.356	0.581/0.742	0.966/1.185	1.428/1.688
	162	16	14	0.080/0.099	0.265/0.313	0.548/0.676	0.920/1.104	1.374/1.589
	164	16	16	0.073/0.088	0.242/0.284	0.501/0.627	0.843/1.041	1.261/1.508
	166	16	18	0.076/0.081	0.253/0.264	0.526/0.591		
Er	144	14	6	0.330/0.308				
	148	14	2	0.646/0.755	1.524/1.344	2.526/1.768	2.784/2.172	2.915/2.814
	150	14	0	1.578/1.255	2.294/1.958	2.621/2.252	2.734/2.541	2.797/3.188
	152	14	2	0.808/0.752	1.470/1.334	1.900/1.746	2.179/2.133	2.943/2.756
	154	14	4	0.560/0.464	1.162/0.938	1.786/1.389	2.328/1.827	3.016/2.424
	156	14	6	0.344/0.299	0.797/0.687	1.340/1.138	1.959/1.595	2.634/2.168
	158	14	8	0.192/0.204	0.527/0.527	0.970/0.960	1.493/1.420	2.072/1.968
	160	14	10	0.125/0.150	0.389/0.424	0.765/0.833	1.229/1.286	1.761/1.812
	162	14	12	0.102/0.118	0.329/0.358	0.666/0.742	1.096/1.183	1.602/1.688
	164	14	14	0.091/0.099	0.299/0.314	0.614/0.675	1.024/1.103	1.518/1.590
	166	14	16	0.080/0.088	0.264/0.286	0.545/0.627	0.911/1.040	1.349/1.510
	168	14	18	0.079/0.081	0.264/0.266	0.548/0.591	0.928/0.990	1.396/1.445
	170	14	20	0.078/0.077	0.260/0.253	0.540/0.563	0.912/0.949	1.373/1.392
	172	14	22	0.077/0.074	0.255/0.243			
Yb	152	12	0	1.531/1.257				
	154	12	2	0.821/0.754	1.516/1.340	1.949/1.751	2.046/2.139	
	156	12	4	0.536/0.466	1.143/0.945	1.728/1.395	2.272/1.833	2.956/2.436
	158	12	6	0.358/0.301	0.835/0.693	1.403/1.144	2.046/1.602	2.743/2.180
	160	12	8	0.243/0.206	0.638/0.533	1.146/0.966	1.736/1.427	2.373/1.981
	162	12	10	0.166/0.151	0.487/0.431	0.924/0.839	1.445/1.294	2.024/1.825

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(Table I. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^+$	$J = 4^+$	$J = 6^+$	$J = 8^+$	$J = 10^+$
	164	12	12	0.123/0.120	0.385/0.365	0.759/0.748	1.222/1.191	1.753/1.702
	166	12	14	0.102/0.101	0.330/0.322	0.668/0.682	1.098/1.111	1.605/1.605
	168	12	16	0.087/0.090	0.286/0.293	0.585/0.634	0.970/1.049	1.425/1.526
	170	12	18	0.084/0.083	0.277/0.274	0.573/0.598	0.963/0.999	1.437/1.462
	172	12	20	0.078/0.079	0.260/0.260	0.539/0.571	0.912/0.959	1.370/1.408
	174	12	22	0.076/0.076	0.253/0.251	0.526/0.549	0.889/0.926	1.336/1.364
	176	12	20	0.082/0.077	0.271/0.253	0.564/0.555	0.954/0.932	1.431/1.369
	178	12	18	0.084/0.079	0.278/0.260	0.576/0.567		
	154	10	0	1.513/1.263				
	156	10	2	0.858/0.759				
Hf	158	10	4	0.476/0.472	1.250/0.962			
	160	10	6	0.389/0.307	0.898/0.711	1.493/1.163	2.147/1.626	2.815/2.212
	162	10	8	0.285/0.212	0.729/0.551	1.292/0.986	1.940/1.451	2.635/2.014
	164	10	10	0.211/0.157	0.587/0.448	1.086/0.859	1.669/1.318	2.305/1.859
	166	10	12	0.158/0.126	0.470/0.382	0.896/0.769	1.406/1.216	1.971/1.737
	168	10	14	0.124/0.107	0.385/0.339	0.756/0.703	1.213/1.137	1.735/1.640
	170	10	16	0.100/0.096	0.321/0.311	0.642/0.655	1.043/1.075	1.505/1.562
	172	10	18	0.095/0.089	0.309/0.292	0.628/0.619	1.037/1.025	1.521/1.498
	174	10	20	0.090/0.085	0.297/0.278	0.608/0.592	1.009/0.985	1.485/1.445
	176	10	22	0.088/0.082	0.290/0.269	0.596/0.571	0.997/0.953	1.481/1.401
	178	10	20	0.093/0.083	0.306/0.272	0.632/0.577	1.058/0.959	1.571/1.407
	180	10	18	0.093/0.085	0.308/0.278	0.640/0.589	1.083/0.973	1.630/1.420
	182	10	16	0.097/0.090	0.322/0.291	0.666/0.610	1.122/0.996	
	184	10	14	0.107/0.099	0.349/0.313	0.717/0.643	1.199/1.031	
W	162	8	6	0.450/0.322				
	164	8	8	0.331/0.227	0.823/0.589	1.431/1.031	2.118/1.503	2.833/2.077
	166	8	10	0.251/0.172	0.675/0.486	1.225/0.905	1.864/1.371	2.551/1.923
	168	8	12	0.199/0.141	0.562/0.420	1.042/0.814	1.600/1.269	2.202/1.802
	170	8	14	0.156/0.122	0.462/0.377	0.875/0.749	1.363/1.190	1.901/1.705
	172	8	16	0.123/0.111	0.377/0.349	0.727/0.701	1.146/1.128	1.617/1.628
	174	8	18	0.113/0.104	0.356/0.330	0.705/0.665	1.138/1.079	1.637/1.565
	176	8	20	0.109/0.100	0.349/0.317	0.700/0.639	1.141/1.040	1.650/1.513
	178	8	22	0.106/0.097	0.343/0.307	0.694/0.618	1.142/1.008	1.666/1.469
	180	8	20	0.103/0.098	0.337/0.310	0.688/0.624	1.138/1.014	1.664/1.475
	182	8	18	0.100/0.100	0.329/0.317	0.680/0.636	1.144/1.028	1.711/1.489
	184	8	16	0.111/0.105	0.364/0.330	0.748/0.657	1.197/1.052	1.861/1.515
	186	8	14	0.122/0.114	0.396/0.351	0.808/0.691	1.348/1.088	
	188	8	12	0.143/0.131	0.442/0.388			
	190	8	10	0.205/0.160				
Os	164	6	6	0.548/0.358				
	166	6	8	0.430/0.264				
	168	6	10	0.341/0.209				
	170	6	12	0.286/0.178	0.749/0.497	1.325/0.907	1.945/1.369	2.545/1.913
	172	6	14	0.227/0.159	0.606/0.455	1.054/0.842	1.524/1.290	2.023/1.817
	174	6	16	0.158/0.148	0.435/0.426	0.777/0.794	1.172/1.229	1.617/1.740
	176	6	18	0.135/0.141	0.395/0.407	0.742/0.759	1.157/1.180	1.633/1.677
	178	6	20	0.131/0.137	0.397/0.394	0.761/0.732	1.193/1.141	1.681/1.626
	180	6	22	0.132/0.134	0.408/0.385	0.770/0.711	1.257/1.109	1.768/1.583
	182	6	20	0.127/0.135	0.400/0.388	0.793/0.718	1.277/1.116	1.811/1.589
	184	6	18	0.119/0.137	0.383/0.395	0.774/0.730	1.274/1.130	1.871/1.604
	186	6	16	0.137/0.142	0.434/0.407	0.868/0.751	1.420/1.154	2.067/1.630
	188	6	14	0.155/0.151	0.477/0.429	0.940/0.785	1.514/1.190	2.169/1.670
	190	6	12	0.186/0.168	0.547/0.465	1.050/0.836	1.666/1.244	2.357/1.729
	192	6	10	0.205/0.198	0.580/0.525	1.089/0.912	1.708/1.320	2.914/1.812
	194	6	8	0.218/0.250	0.601/0.621			
	196	6	6	0.300/0.343	0.760/0.774			
Pt	168	4	8	0.582/0.351				
	170	4	10	0.509/0.296				
	172	4	12	0.457/0.264				
	174	4	14	0.394/0.246	0.892/0.607	1.356/1.021	1.827/1.469	2.329/1.998
	176	4	16	0.263/0.235	0.564/0.579	0.905/0.974	1.306/1.408	1.764/1.922
	178	4	18	0.170/0.228	0.427/0.560			
	180	4	20	0.152/0.224	0.410/0.547	0.757/0.912	1.181/1.321	1.674/1.809
	182	4	22	0.154/0.221	0.419/0.538	0.774/0.891	1.205/1.289	1.697/1.766

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(Table I. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^+$	$J = 4^+$	$J = 6^+$	$J = 8^+$	$J = 10^+$
	184	4	20	0.162/0.222	0.435/0.541	0.798/0.898	1.230/1.296	1.706/1.773
	186	4	18	0.191/0.224	0.490/0.548	0.877/0.911	1.341/1.311	1.856/1.788
	188	4	16	0.265/0.229	0.671/0.561	1.184/0.932	1.782/1.335	2.438/1.814
	190	4	14	0.295/0.238	0.737/0.582	1.287/0.966	1.915/1.371	2.535/1.855
	192	4	12	0.316/0.255	0.784/0.619	1.365/1.017	2.018/1.425	2.518/1.914
	194	4	10	0.328/0.285	0.811/0.678	1.411/1.093	2.423/1.501	2.438/1.998
	196	4	8	0.355/0.337	0.876/0.774	1.429/1.204	2.252/1.608	3.044/2.115
	198	4	6	0.407/0.430	0.985/0.927	1.714/1.367		
	200	4	4	0.470/0.593	1.103/1.172			
Hg	176	2	14	0.613/0.449				
	178	2	16	0.558/0.438				
	180	2	18	0.434/0.431	0.706/0.859	1.032/1.279	1.436/1.670	1.913/2.147
	182	2	20	0.351/0.427	0.613/0.846	0.946/1.253	1.360/1.631	1.847/2.097
	184	2	22	0.366/0.424	0.653/0.837	0.993/1.232	1.412/1.600	1.901/2.055
	186	2	20	0.405/0.425	0.808/0.840	1.165/1.239	1.589/1.608	2.078/2.062
	188	2	18	0.412/0.427	1.004/0.847	1.509/1.252	1.969/1.623	2.490/2.078
	190	2	16	0.416/0.432	1.041/0.860	1.772/1.274	2.464/1.647	2.596/2.105
	192	2	14	0.422/0.441	1.057/0.882	1.803/1.308	2.447/1.684	2.507/2.146
	194	2	12	0.428/0.458	1.064/0.918	1.799/1.359	2.364/1.737	2.423/2.205
	196	2	10	0.425/0.487	1.061/0.978	1.785/1.435	2.262/1.814	2.342/2.290
	198	2	8	0.411/0.540			2.337/1.921	2.434/2.406
	200	2	6	0.367/0.633	0.947/1.227	1.706/1.709	2.679/2.069	
	202	2	4	0.439/0.796	1.119/1.471	1.988/1.945		
	204	2	2	0.436/1.082	1.128/1.860	2.191/2.286		
	206	2	0	1.068/1.583				
Pb	182	0	18	0.888/0.902				
	184	0	20	0.701/0.897				
	186	0	22	0.662/0.895	0.923/1.418	1.260/1.873	1.675/2.132	2.160/2.504
	188	0	20	0.723/0.896	1.064/1.422	1.435/1.880	1.869/2.140	2.368/2.512
	190	0	18	0.773/0.898	1.280/1.429			
	192	0	16	0.853/0.903	1.355/1.442	1.920/1.915	2.520/2.179	2.581/2.555
	194	0	14	0.965/0.912	1.540/1.464	2.135/1.948	2.438/2.217	2.581/2.597
	196	0	12	1.049/0.929	1.739/1.500	2.376/2.000	2.590/2.271	2.645/2.657
	198	0	10	1.063/0.958	1.625/1.560	2.099/2.076		2.772/2.741
	200	0	8	1.026/1.011	1.488/1.656			2.960/2.859
	202	0	6	0.960/1.104	1.382/1.809	2.750/2.351		3.003/3.019
	204	0	4	0.899/1.267	1.274/2.054	2.808/2.587		3.450/3.235
	206	0	2	0.803/1.553	1.684/2.442	3.260/2.928	3.960/3.086	3.957/3.526
	208	0	0	4.085/2.054	4.323/3.060	4.422/3.418	4.610/3.466	4.895/3.916
	210	0	2	0.799/1.551	1.097/2.438	1.195/2.918	1.279/3.069	1.799/3.501
	212	0	4	0.804/1.264	1.117/2.045	1.277/2.567	1.355/2.772	
	214	0	6	0.836/1.100				
Po	192	2	18	0.262/0.425				
	194	2	16	0.318/0.430				
	196	2	14	0.463/0.440	0.891/0.877	1.390/1.296	1.938/1.663	2.591/2.115
	198	2	12	0.605/0.456	1.158/0.913	1.717/1.347	1.853/1.717	2.692/2.176
	200	2	10	0.665/0.486	1.277/0.973	1.761/1.424	1.773/1.794	2.804/2.261
	202	2	8	0.677/0.539	1.249/1.069	1.691/1.536	1.712/1.902	
	204	2	6	0.684/0.631	1.200/1.222	1.626/1.699	1.639/2.051	2.527/2.539
	206	2	4	0.700/0.794	1.177/1.467	1.573/1.935	1.585/2.255	2.418/2.755
	208	2	2	0.686/1.080	1.346/1.855	1.524/2.276	1.528/2.534	2.554/3.047
	210	2	0	1.181/1.581	1.426/2.473	1.473/2.767	1.556/2.914	
	212	2	2	0.727/1.079	1.132/1.851	1.355/2.266	1.476/2.517	1.833/3.022
	214	2	4	0.609/0.792				
	216	2	6	0.549/0.627				
	218	2	8	0.511/0.533				
Rn	198	4	14	0.339/0.235				
	200	4	12	0.432/0.252				
	202	4	10	0.504/0.282				
	204	4	8	0.542/0.334	1.131/0.764	1.772/1.182	2.032/1.570	
	206	4	6	0.575/0.427	1.134/0.918	1.762/1.346	1.924/1.719	2.534/2.219
	208	4	4	0.635/0.590	1.188/1.162	1.578/1.582	1.828/1.923	2.465/2.436
	210	4	2	0.643/0.876	1.461/1.551	1.664/1.923	1.664/2.202	2.376/2.728
	212	4	0	1.273/1.377	1.501/2.168	1.639/2.414	1.694/2.583	2.655/3.119

(continued on next page)

(Table I. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^+$	$J = 4^+$	$J = 6^+$	$J = 8^+$	$J = 10^+$
	214	4	2	0.694/0.875	1.141/1.547	1.442/1.913	1.625/2.186	1.928/2.704
	216	4	4	0.461/0.587	0.840/1.154	1.226/1.563	1.645/1.890	2.111/2.387
	218	4	6	0.324/0.423				
	220	4	8	0.240/0.329				
	222	4	10	0.186/0.275				
Ra	206	6	8	0.474/0.246				
	208	6	6	0.520/0.338				
	210	6	4	0.603/0.501				
	212	6	2	0.629/0.787	1.454/1.393	1.895/1.731	1.958/2.002	2.577/2.514
	214	6	0	1.382/1.288	1.639/2.010	1.819/2.222	1.865/2.383	2.944/2.905
	216	6	2	0.688/0.786	1.164/1.389	1.507/1.721	1.711/1.986	2.026/2.490
	218	6	4	0.389/0.499	0.741/0.995	1.122/1.371	1.547/1.690	1.962/2.174
	220	6	6	0.178/0.335		0.687/1.125	0.999/1.469	1.341/1.933
	222	6	8	0.111/0.240				
	224	6	10	0.084/0.186				
	226	6	12	0.067/0.155		0.416/0.744	0.669/1.085	0.960/1.496
	228	6	14	0.063/0.137				
	230	6	16	0.057/0.127		0.379/0.639		
Th	216	8	0	1.478/1.250				
	218	8	2	0.689/0.747	1.194/1.306	1.563/1.616	1.765/1.864	2.104/2.347
	220	8	4	0.373/0.460	0.759/0.913	1.165/1.266	1.598/1.568	2.012/2.031
	222	8	6	0.183/0.296	0.439/0.664	0.750/1.020	1.093/1.347	1.461/1.789
	224	8	8	0.098/0.202	0.283/0.506	0.534/0.847	0.833/1.182	1.171/1.605
	226	8	10	0.072/0.148	0.226/0.406			
	228	8	12	0.057/0.117	0.186/0.342	0.378/0.640	0.622/0.964	0.911/1.353
	230	8	14	0.053/0.099	0.174/0.301	0.356/0.579	0.594/0.892	0.879/1.268
	232	8	16	0.049/0.088	0.162/0.275	0.333/0.535	0.556/0.838	0.827/1.201
U	234	8	18	0.049/0.082	0.163/0.257	0.336/0.503	0.564/0.796	0.843/1.149
	226	10	8	0.080/0.185				
	228	10	10	0.059/0.131				
	230	10	12	0.051/0.100	0.169/0.299	0.347/0.582	0.578/0.889	0.856/1.256
	232	10	14	0.047/0.082	0.156/0.258	0.322/0.520	0.541/0.818	0.805/1.171
	234	10	16	0.043/0.071	0.143/0.231	0.296/0.477	0.497/0.764	0.741/1.105
	236	10	18	0.045/0.065	0.149/0.214	0.309/0.445	0.522/0.722	0.782/1.052
	238	10	20	0.044/0.061	0.148/0.202	0.307/0.422	0.518/0.689	0.775/1.010
	240	10	22	0.045/0.059	0.151/0.194			
Pu	236	12	16	0.044/0.064	0.147/0.208	0.305/0.444	0.515/0.717	0.773/1.038
	238	12	18	0.044/0.058	0.145/0.191	0.303/0.412	0.513/0.675	0.772/0.986
	240	12	20	0.042/0.054	0.141/0.179	0.294/0.389	0.497/0.643	0.747/0.944
	242	12	22	0.044/0.052	0.147/0.171	0.306/0.372	0.518/0.617	0.778/0.911
	244	12	24	0.046/0.050	0.156/0.166	0.319/0.359	0.536/0.597	0.798/0.884
	246	12	26	0.044/0.049	0.155/0.162			
Cm	238	14	16	0.035/0.060				
	240	14	18	0.038/0.054				
	242	14	20	0.042/0.050	0.138/0.166	0.284/0.370		
	244	14	22	0.042/0.048	0.142/0.159	0.296/0.353	0.501/0.587	
	246	14	24	0.042/0.046	0.142/0.153	0.294/0.340	0.500/0.567	
	248	14	26	0.043/0.045	0.143/0.149	0.298/0.330	0.506/0.551	0.761/0.815
	250	14	28	0.043/0.045				
Cf	244	16	20	0.040/0.049				
	248	16	24	0.041/0.045	0.137/0.146	0.285/0.328		
	250	16	26	0.042/0.044	0.141/0.142	0.296/0.319		
	252	16	28	0.045/0.043	0.151/0.139			
Fm	248	18	22	0.044/0.045				
	250	18	24	0.044/0.044				
	252	18	26	0.046/0.043				
	254	18	28	0.044/0.042	0.149/0.135	0.934/0.303		
	256	18	28	0.048/0.041	0.159/0.133	0.332/0.300	0.563/0.498	

Table 2

Yrast energies of the natural parity odd multipole states in even-even nuclei.

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^-$	$J = 3^-$	$J = 5^-$	$J = 7^-$	$J = 9^-$
He	4	0	0	23.64/28.34				
	6	0	2	13.60/20.17				
Be	6	2	0		27.00/12.15			
	8	2	2	19.40/15.07				
	10	2	2	5.960/12.80	7.371/10.56			
C	12	2	2	10.84/11.24	9.641/9.939			
	14	2	0	6.094/11.45	6.728/9.980	11.73/14.25		
O	14	0	2	5.173/11.57	6.272/9.630			
	16	0	0	7.117/12.05	6.130/8.368	14.66/13.18		
	18	0	2	4.456/9.985	5.098/7.572	7.865/11.37	18.95/16.26	
	20	0	4		5.614/8.328			
Ne	18	2	0	4.519/9.866	5.153/7.197			
	20	2	2	5.788/7.930	5.621/6.499	8.453/10.05	13.34/14.38	17.43/19.48
	22	2	4	6.691/6.888	5.910/5.825	9.648/9.013		
Mg	24	4	4	7.555/6.010	7.616/5.389	10.03/8.158	12.44/11.67	
	26	4	6	7.063/5.429	6.876/5.168	7.953/7.501		
	28	4	4		5.172/5.354			
Si	26	6	4		6.789/4.965			
	28	6	6	8.905/4.977	6.879/4.781	9.702/6.917		
	30	6	4	6.744/4.948	5.488/4.758	7.044/6.610		
	32	6	2	6.705/5.280	5.289/5.095	8.321/6.510		
	34	6	0		4.257/4.662			
S	32	4	4	5.798/4.866	5.006/4.665	6.762/6.357		
	34	4	2	6.342/5.223	4.624/5.024	5.689/6.298		
	36	4	0	5.022/6.400	4.193/4.716	7.272/6.657		
	38	4	2	3.375/4.868				
Ar	34	2	4		4.513/4.740	5.310/6.244		
	36	2	2	5.836/5.511	4.178/5.117	5.171/6.219		
	38	2	0	5.084/6.705	3.810/4.413	4.586/6.607	8.491/8.565	
	40	2	2	4.769/5.189	3.681/5.158	4.494/5.727		
Ca	38	0	2		3.695/5.551			
	40	0	0	5.903/8.035	3.737/4.860	4.491/6.770		
	42	0	2	3.885/6.531	3.447/4.516	4.100/5.911	5.744/7.493	
	44	0	4	3.676/5.838	3.308/4.610	3.712/5.454		
	46	0	2		3.614/5.048	4.185/5.540		
	48	0	0	6.105/7.540	4.507/4.397	5.729/6.023		
	50	0	2		3.993/4.141			
Ti	44	2	2	3.756/4.920	3.176/3.807	4.061/5.320		
	46	2	4	3.168/4.237	3.058/3.910	3.827/4.880	5.198/6.341	6.830/8.337
	48	2	2	3.699/4.694	3.359/4.356	4.046/4.979	5.312/6.330	
	50	2	0	4.487/5.956	4.410/3.712	6.380/5.475		
	52	2	2	4.098/4.499	3.453/3.431			
Cr	48	4	4		4.067/3.543	6.420/4.507		
	50	4	2		4.052/3.996	4.363/4.619		
	52	4	0	7.730/5.388	4.563/3.359	5.811/5.126		
	54	4	2	3.393/3.937	4.127/3.061			
	56	4	4		3.451/3.712			
Fe	52	2	2	6.882/4.499	4.397/4.172	4.852/4.689		
	54	2	0	6.563/5.775	4.782/3.540	5.045/5.206		
	56	2	2	5.186/4.330	4.510/3.248	5.122/4.438	6.041/5.514	
	58	2	4		3.861/3.092	2.962/4.062		
	60	2	6		3.293/4.678			

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(Table 2. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^-$	$J = 3^-$	$J = 5^-$	$J = 7^-$	$J = 9^-$
Ni	56	0	0	6.011/7.176	4.923/4.052	4.923/5.482		
	58	0	2	6.024/5.736	4.475/3.765			
	60	0	4		4.040/3.612		5.349/5.295	
	62	0	6	7.646/4.796	3.757/3.515	4.160/4.148		
	64	0	8		3.560/3.441	3.849/4.011	4.600/4.907	
	66	0	10		3.371/3.390	3.390/3.906	4.050/4.769	
Zn	60	2	2		3.511/3.107			
	62	2	4	3.870/3.548	3.209/2.958	4.043/3.857		
	64	2	6	3.701/3.250	2.998/2.865	3.465/3.657	4.636/4.587	5.626/5.926
	66	2	8	3.381/3.092	2.827/2.794	3.747/3.526	4.252/4.432	5.465/5.678
	68	2	10	3.815/2.995	2.750/2.739	3.459/3.426		
	70	2	10	3.844/2.941	2.859/2.777	3.506/3.348		
Ge	64	4	4		2.970/2.633	3.717/3.555	4.244/4.500	5.371/5.892
	66	4	6		2.495/2.542	3.685/3.360	4.208/4.293	4.546/5.561
	68	4	8		2.649/2.474	3.582/3.234	4.054/4.146	5.331/5.324
	70	4	10	3.314/2.467	2.561/2.422	3.417/3.138	3.955/4.023	
	72	4	10	2.940/2.416	2.515/2.386	3.129/3.064	3.688/3.914	4.742/4.991
	74	4	8	2.165/2.407	2.536/2.371	2.877/3.012		
	76	4	6		2.692/2.368	3.195/2.989		
	78	4	4	3.236/2.649		2.652/3.032		
Se	70	6	8		2.517/2.303	3.386/3.046	3.913/3.952	4.895/5.070
	72	6	10		2.406/2.254	2.843/2.954		
	74	6	10		2.350/2.220	2.843/2.884	3.516/3.733	4.403/4.754
	76	6	8		2.429/2.208	2.825/2.835	3.442/3.644	4.325/4.662
	78	6	6	2.560/2.263	2.507/2.249	2.900/2.815	3.550/3.577	4.412/4.616
	80	6	4	2.514/2.455	2.717/2.422	3.996/2.862		
	82	6	2	4.809/2.980	3.010/2.154	2.894/3.067		
	84	6	0	2.122/4.305		5.437/3.659		
Kr	74	8	10			2.501/2.826	2.893/3.695	
	76	8	10		2.257/2.122	2.683/2.759	3.288/3.598	4.072/4.572
	78	8	8		2.399/2.111	2.750/2.713	3.288/3.514	4.028/4.487
	80	8	6		2.439/2.154	2.859/2.696	3.530/3.452	4.393/4.447
	82	8	4		2.548/2.329	2.828/2.746	3.497/3.446	4.668/4.496
	84	8	2	3.225/2.893	2.700/2.840	2.771/2.954		
	86	8	0	5.519/4.220	3.099/2.008	3.935/3.549		
	88	8	2	4.708/2.821				
	90	8	4		1.506/2.047			
Sr	82	10	6		2.402/2.091	2.817/2.608	3.511/3.351	4.387/4.309
	84	10	4		2.448/2.268	2.769/2.660	3.488/3.349	4.636/4.363
	86	10	2		2.482/2.781	2.673/2.871		
	88	10	0	5.077/4.169	2.734/2.198	3.585/3.468	4.171/4.166	
	90	10	2		2.207/1.835	3.146/2.773		
	92	10	4	4.638/2.174				
Zr	94	10	6		1.926/2.232			
	84	10	6			2.825/2.553	3.493/3.272	4.378/4.205
	86	10	4			2.706/2.608	3.423/3.274	4.429/4.264
	88	10	2		2.456/2.746	2.539/2.821	3.214/3.439	4.486/4.501
	90	10	0	4.980/4.135	2.748/2.165	2.319/3.420	4.232/4.098	
	92	10	2	3.372/2.739	2.340/1.919	2.486/2.727	3.380/3.304	3.999/4.325
	94	10	4	2.846/2.143	2.058/1.805	2.605/2.420	4.149/3.004	
	96	10	6	4.838/1.878	1.897/1.742	3.120/2.271	4.234/2.866	
	98	10	8	2.797/1.752	1.806/1.669	2.800/2.187	3.886/2.782	
Mo	102	10	12		1.387/2.222			
	90	8	2		2.433/2.737	2.549/2.804		
	92	8	0	5.007/4.118	2.850/2.157	2.527/3.405	3.624/4.050	4.251/5.048
	94	8	2	3.264/2.724	2.534/1.912	2.612/2.714	3.367/3.259	
	96	8	4	4.714/2.128	2.235/1.799	3.020/2.408		
	98	8	6	2.509/1.865	2.018/1.738	2.575/2.261	3.097/2.826	3.657/3.626
	100	8	8	6.419/1.739	1.908/1.698	3.085/2.178		
	102	8	10		1.881/2.759			

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(Table 2. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^-$	$J = 3^-$	$J = 5^-$	$J = 7^-$	$J = 9^-$
Ru	92	6	2			2.535/2.816	3.174/3.359	3.948/4.406
	94	6	0		2.965/2.180	2.625/3.419	3.658/4.024	4.198/5.019
	96	6	2		3.076/1.936	2.588/2.730	3.291/3.236	3.951/4.245
	98	6	4		2.435/1.824	2.657/2.426	3.283/2.941	3.851/3.837
	100	6	6	2.469/1.885	2.167/1.764	2.528/2.280	2.953/2.807	3.505/3.607
	102	6	8		2.044/1.725			3.385/3.461
	104	6	10		1.970/1.916			
Pd	96	4	0			2.649/3.487		
	98	4	2			2.620/2.799		
	100	4	4			2.505/2.497	3.231/2.963	4.093/3.866
	102	4	6		2.343/1.857	2.474/2.353	3.188/2.833	3.728/3.638
	104	4	8		2.194/1.819	2.491/2.273	2.988/2.756	3.368/3.496
	106	4	10	2.485/1.821	2.084/1.789	2.398/2.220	2.793/2.698	3.290/3.396
	108	4	12		2.047/1.764	2.318/2.180		
Cd	110	4	14	2.125/1.750	2.038/2.096	2.295/2.144		
	106	2	8		2.379/2.059	2.629/2.447	3.410/2.871	3.679/3.624
	108	2	10	2.678/2.271	2.202/2.030	2.602/2.396	3.057/2.815	3.485/3.526
	110	2	12	2.649/2.231	2.079/2.005	2.540/2.356	3.029/2.767	3.346/3.449
	112	2	14	2.416/2.202	2.005/1.982	2.373/2.322		3.320/3.384
	114	2	16	2.456/2.177	1.958/1.962	2.540/2.291		
	116	2	14	2.722/2.159	1.922/1.943	2.249/2.262		
Sn	118	2	12	2.789/2.145	1.935/2.625	1.973/2.237	1.269/2.599	
	120	2	10				1.323/2.563	
	106	0	6					4.388/4.063
	108	0	8				3.588/3.169	4.177/3.926
	110	0	10		2.459/2.597	3.357/2.761	3.689/3.115	3.935/3.830
	112	0	12		2.355/2.572	3.137/2.722	3.354/3.068	3.694/3.756
	114	0	14		2.275/2.550	2.815/2.689	3.087/3.024	3.511/3.692
Te	116	0	16	2.702/3.639	2.266/2.530	2.366/2.658	2.909/2.983	3.523/3.635
	118	0	14	2.817/3.621	2.325/2.512	2.321/2.631	2.575/2.943	3.559/3.588
	120	0	12	2.297/3.608	2.401/2.497	2.284/2.607	2.482/2.906	2.836/3.546
	122	0	10		2.493/2.491	2.246/2.587	2.409/2.871	3.531/3.516
	124	0	8		2.603/2.505	2.205/2.579	2.325/2.844	
	126	0	6		2.720/3.299	2.162/2.598	2.219/2.834	
	128	0	4	2.258/3.923		2.121/2.680	2.092/2.878	2.413/3.651
Xe	130	0	2			2.085/2.920	1.947/3.083	4.206/3.941
	132	0	0		4.352/1.940	4.942/3.544		
	114	2	12				3.154/2.680	3.514/3.337
	116	2	14			2.120/2.262	3.028/2.638	3.432/3.275
	118	2	16		1.945/1.903		3.000/2.598	3.460/3.220
	120	2	14			2.461/2.207	2.899/2.560	3.374/3.174
	122	2	12		2.196/1.889	2.408/2.183	2.801/2.523	
Ba	124	2	10	2.747/2.104	2.294/1.883	2.335/2.164	2.674/2.490	
	126	2	8	4.505/2.126	2.386/1.898	2.218/2.157	2.497/2.464	3.194/3.096
	128	2	6		2.494/1.964	2.133/2.176	2.338/2.455	
	130	2	4		2.730/2.162	2.101/2.260	2.146/2.500	3.081/3.245
	132	2	2		2.281/1.725	2.053/2.500	1.925/2.706	
	114	4	10		1.624/1.606	1.798/2.093	2.173/2.518	2.730/3.162
	118	4	14			1.995/2.025	2.419/2.434	2.919/3.032
Xe	122	4	14			2.565/1.971	2.565/2.358	3.033/2.934
	124	4	12				2.626/2.323	3.113/2.896
	126	4	10		2.005/1.601	2.301/1.930	2.592/2.291	3.064/2.868
	128	4	8		2.139/1.683	2.229/1.923	2.583/2.265	
	130	4	6			2.060/1.943	2.375/2.258	3.071/2.895
	132	4	4		2.469/2.413	2.040/2.028	2.214/2.304	
	134	4	2				1.966/2.510	
Ba	136	4	0	4.454/3.829	3.275/1.849			
	138	4	2		2.015/1.482			
	126	6	12		1.743/1.464	1.939/1.812	2.303/2.209	2.787/2.750
	128	6	10			2.039/1.795	2.396/2.178	2.906/2.724
	130	6	8		1.948/1.480	2.168/1.790	2.568/2.154	3.067/2.718
	132	6	6	3.158/1.546	2.069/1.547	2.120/1.810	2.483/2.148	3.189/2.753

(continued on next page)

(Table 2. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^-$	$J = 3^-$	$J = 5^-$	$J = 7^-$	$J = 9^-$
	134	6	4		2.255/1.745	1.986/1.895	2.271/2.194	
	136	6	2	3.046/2.314	2.532/2.278	2.140/2.136	2.031/2.402	
	138	6	0	4.026/3.662	2.881/1.714	3.857/2.762		3.633/3.823
	140	6	2	2.704/2.284	1.803/1.485			
	142	6	4	1.326/1.704	1.292/1.387			
	144	6	6	0.759/1.455	0.838/1.341	1.039/1.686	1.356/1.976	1.773/2.533
	146	6	8	0.739/1.344	0.821/1.314	1.024/1.624	1.349/1.925	1.777/2.424
	148	6	10	0.687/1.290	0.775/1.676			
	Ce	128	8	12		1.890/1.730	2.246/2.138	2.737/2.653
	130	8	10			1.955/1.714	2.313/2.108	2.761/2.628
	132	8	8					2.341/2.624
	136	8	4			1.979/1.815	2.307/2.127	3.278/2.780
	138	8	2		2.394/2.209	2.217/2.057	2.129/2.336	
	140	8	0	3.640/3.599	2.464/1.646	3.256/2.684	3.425/3.035	3.493/3.734
	142	8	2	2.187/2.221	1.653/1.418			
	144	8	4	3.008/1.641	1.242/1.320	1.524/1.735		
	146	8	6	0.925/1.393	0.961/1.273	1.183/1.609	1.551/1.913	2.021/2.446
	148	8	8	0.760/1.282	0.841/1.637			
	Nd	132	10	10		1.883/1.660	2.223/2.059	2.688/2.560
	134	10	8			1.956/1.656	2.341/2.036	2.841/2.556
	136	10	6			2.036/1.678	2.440/2.032	2.941/2.593
	138	10	4			1.991/1.764	2.321/2.080	
	140	10	2		2.124/2.171	2.276/2.006	2.221/2.290	3.455/3.010
	142	10	0	4.145/3.569	2.084/1.608	2.977/2.633	3.243/2.990	3.486/3.671
	144	10	2	2.186/2.191	1.511/1.379	2.093/1.967	2.613/2.236	3.396/2.941
	146	10	4	1.377/1.612	1.190/1.282	1.518/1.685	2.030/1.972	2.700/2.577
	148	10	6	1.023/1.364	0.999/1.236	1.242/1.560	1.645/1.870	2.132/2.386
	150	10	8	0.853/1.253	0.935/1.210	1.129/1.499		
	152	10	10	1.149/1.200	1.239/1.611			
	Sm	136	12	8			2.275/1.998	2.738/2.503
	138	12	6				2.508/1.994	3.028/2.542
	140	12	4			2.015/1.727	2.326/2.044	3.128/2.664
	142	12	2		1.784/2.145	2.348/1.970	2.372/2.254	3.387/2.961
	144	12	0	3.225/3.550	1.810/1.583	2.825/2.598	3.124/2.955	3.461/3.622
	146	12	2		1.380/1.355	2.083/1.932	2.600/2.201	2.798/2.894
	148	12	4	1.465/1.593	1.162/1.258	1.954/1.651	2.129/1.939	2.807/2.530
	150	12	6	1.166/1.345	1.071/1.212	1.358/1.526	1.765/1.837	2.233/2.340
	152	12	8	0.963/1.235	1.041/1.187	1.222/1.465	1.506/1.788	1.879/2.234
	154	12	10	0.921/1.182	1.012/1.169	1.181/1.431	1.431/1.756	1.760/2.169
	156	12	12	0.804/1.153	0.876/1.592	1.021/1.407		
	Gd	140	14	6				3.034/2.498
	142	14	4			2.032/1.699	2.342/2.012	3.070/2.621
	144	14	2		1.702/2.126	2.303/1.942	2.472/2.223	3.346/2.919
	146	14	0		1.579/1.564	2.658/2.570	2.982/2.925	3.428/3.581
	148	14	2		1.273/1.337	2.082/1.905	2.564/2.172	2.695/2.854
	150	14	4	2.426/1.578	1.134/1.240	1.701/1.624	2.211/1.910	2.816/2.491
	152	14	6	1.315/1.331	1.123/1.194	1.470/1.500	1.880/1.809	2.331/2.302
	154	14	8	1.241/1.221	1.252/1.169	1.365/1.440	1.675/1.761	2.041/2.197
	156	14	10	1.242/1.168	1.276/1.152	1.408/1.406	1.638/1.730	1.958/2.132
	158	14	12	0.977/1.140	1.042/1.138	1.176/1.382	1.391/1.705	1.685/2.087
	160	14	14	1.224/1.121	1.290/1.576	1.427/1.364	1.640/1.683	
	Dy	146	16	2		1.783/2.111	2.282/1.919	2.519/2.195
	148	16	0		1.688/1.549	2.348/2.548	2.738/2.898	
	150	16	2		1.395/1.321			2.813/2.818
	152	16	4		1.228/1.225	1.782/1.603	2.342/1.884	2.906/2.456
	154	16	6	1.420/1.318	1.208/1.180	1.546/1.479	1.965/1.784	2.421/2.268
	156	16	8	1.293/1.208	1.369/1.155	1.526/1.419	1.810/1.736	2.187/2.164
	158	16	10	1.442/1.156	1.397/1.138	1.528/1.385		
	160	16	12	1.286/1.128	1.287/1.124	1.409/1.362	1.614/1.682	1.901/2.055
	162	16	14	1.276/1.109	1.210/1.112	1.391/1.344	1.638/1.660	1.940/2.021
	164	16	16	1.675/1.095	1.039/1.101	1.225/1.328	1.505/1.639	
	166	16	18		1.095/2.099			

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(Table 2. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^-$	$J = 3^-$	$J = 5^-$	$J = 7^-$	$J = 9^-$
Er	148	14	2			2.254/1.905	2.537/2.172	
	150	14	0		1.786/1.538	2.261/2.534	2.634/2.875	
	152	14	2		1.524/1.215			
	154	14	4			1.896/1.590	2.461/1.863	3.014/2.431
	156	14	6	1.518/1.306	1.304/1.170	1.478/1.467	2.031/1.763	2.491/2.244
	158	14	8	1.418/1.197	1.342/1.129			2.273/2.140
	160	14	10					2.104/2.077
	162	14	12	1.352/1.117	1.357/1.115	1.469/1.351	1.682/1.663	1.986/2.033
	164	14	14	1.387/1.098	1.434/1.103	1.555/1.333	1.764/1.641	2.055/1.999
	166	14	16	1.662/1.085	1.514/1.092	1.666/1.317	1.993/1.621	2.246/1.969
	168	14	18	1.359/1.073	1.431/1.081	1.193/1.303	1.449/1.602	
Yb	170	14	20	1.266/1.062	1.304/2.091	1.372/1.288	1.591/1.583	
	152	12	0		1.890/1.163	2.202/2.525	2.549/2.856	
	158	12	6				2.121/1.745	2.574/2.223
	160	12	8	1.525/1.187	1.255/1.109		1.927/1.699	2.372/2.121
	162	12	10				1.768/1.669	2.153/2.058
	164	12	12			1.443/1.345	1.675/1.646	2.000/2.015
	166	12	14	1.359/1.089	1.419/1.097	1.505/1.327	1.833/1.625	1.942/1.981
	168	12	16		1.480/1.086	1.770/1.312	2.111/1.606	
	170	12	18	1.365/1.064	1.398/1.076	1.345/1.297	1.573/1.587	1.872/1.927
	172	12	20	1.155/1.053	1.222/1.066	1.353/1.283	1.558/1.568	1.840/1.902
	174	12	22	1.711/1.043	1.382/1.056	1.572/1.270		
Hf	176	12	20		1.542/2.089			
	154	10	0		2.011/1.138	2.146/2.525	2.457/2.841	
	160	10	6				2.256/1.732	2.714/2.211
	162	10	8			1.649/1.401	2.039/1.686	2.489/2.109
	164	10	10		1.073/1.066	1.522/1.368	1.837/1.657	2.246/2.047
	166	10	12			1.466/1.346	1.726/1.635	2.079/2.004
	168	10	14					2.067/1.971
	172	10	18			1.504/1.300	1.727/1.577	1.968/1.918
	174	10	20			1.443/1.286	1.651/1.558	1.944/1.894
	176	10	22	1.643/1.038	1.313/1.057	1.509/1.273	1.785/1.541	1.785/1.871
	178	10	20	1.310/1.029	1.322/1.047	1.513/1.260	1.948/1.523	1.364/1.850
W	180	10	18	1.354/1.020	1.374/1.122	1.444/1.248		
	166	8	10			1.587/1.384	1.928/1.655	2.337/2.050
	168	8	12			1.536/1.363	1.834/1.633	2.213/2.008
	170	8	14		1.314/1.111	1.517/1.346	1.792/1.613	2.154/1.975
	172	8	16		1.318/1.101		1.762/1.595	2.106/1.948
	174	8	18		1.258/1.091	1.401/1.317	1.676/1.576	1.999/1.923
	176	8	20		1.199/1.081	1.402/1.304	1.675/1.559	2.009/1.900
	178	8	22		1.121/1.071	1.345/1.291	1.657/1.541	1.965/1.878
	180	8	20	1.633/1.035	1.082/1.062	1.308/1.278	1.624/1.524	1.726/1.857
	182	8	18	1.871/1.026	1.374/1.053	1.621/1.266	1.917/1.508	2.274/1.837
	184	8	16	1.284/1.018	1.221/1.045	1.285/1.255	1.502/1.492	
Os	186	8	14	6.418/1.012	1.045/1.165			
	170	6	12			1.697/1.407	2.084/1.652	2.053/2.037
	172	6	14		1.469/1.154	1.656/1.390	1.978/1.632	2.375/2.005
	174	6	16		1.421/1.144	1.596/1.376	1.861/1.614	2.206/1.978
	176	6	18		1.350/1.134	1.516/1.362	1.753/1.596	2.076/1.954
	178	6	20		1.302/1.125	1.538/1.349	1.781/1.579	2.098/1.931
	180	6	22		1.376/1.115	1.605/1.336	1.863/1.562	2.114/1.909
	182	6	20		1.472/1.106	1.654/1.324	1.878/1.545	2.014/1.889
	184	6	18		1.544/1.097	1.718/1.312	1.958/1.529	
	186	6	16		1.480/1.089	1.629/1.301	1.775/1.514	2.188/1.851
	188	6	14		1.414/1.083	1.669/1.291	1.771/1.498	
Pt	190	6	12		1.387/1.079	1.682/1.282	2.061/1.484	
	192	6	10		1.341/1.216			
	176	4	16			1.699/1.473	2.011/1.675	2.374/2.057
	180	4	20			1.615/1.447	1.852/1.640	2.169/2.011
	182	4	22			1.670/1.435	1.924/1.624	2.238/1.990
	184	4	20			1.671/1.423	1.914/1.608	2.022/1.970
	186	4	18		1.408/1.208	1.692/1.411	1.952/1.592	2.356/1.951
	188	4	16	1.776/1.201	1.350/1.200	1.566/1.400	1.769/1.577	2.313/1.933

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(Table 2. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^-$	$J = 3^-$	$J = 5^-$	$J = 7^-$	$J = 9^-$
	190	4	14	1.737/1.195	1.353/1.193	1.465/1.390	1.631/1.562	2.044/1.918
	192	4	12	1.740/1.194	1.378/1.190	1.384/1.382	1.518/1.548	2.103/1.907
	194	4	10	1.797/1.202	1.433/1.194	1.374/1.378	1.485/1.536	2.048/1.906
	196	4	8	1.795/1.234	1.447/1.219	1.270/1.385	1.374/1.530	1.821/1.924
	198	4	6		1.680/1.481	1.367/1.418	1.502/1.541	
	200	4	4			1.567/1.515	1.617/1.605	
	Hg	186	2		1.228/1.451		2.185/1.757	2.394/2.142
		188	2	1.719/1.674		1.910/1.609	2.201/1.741	2.470/2.123
		190	2			1.881/1.598	2.078/1.726	2.335/2.106
		192	2			1.844/1.588	1.977/1.712	2.224/2.091
		194	2			1.813/1.580	1.910/1.698	2.144/2.081
		196	2			1.757/1.577	1.841/1.686	2.064/2.080
		198	2		1.930/1.476	1.636/1.584	1.683/1.681	1.911/2.099
		200	2	2.591/1.790	2.151/1.552	1.852/1.617	1.963/1.692	2.144/2.157
		202	2	4.922/2.017	2.357/1.758	1.965/1.714		
		204	2		2.675/2.031	2.263/1.967	2.300/1.981	
		206	2			2.102/2.605		
	Pb	188	0					2.705/2.486
		192	0			1.860/1.984	2.303/2.056	2.514/2.451
		194	0			1.821/1.974	2.242/2.042	2.408/2.437
		196	0		1.992/2.057	1.798/1.967	2.169/2.029	2.308/2.427
		198	0			1.824/1.963	2.141/2.017	2.231/2.426
		200	0			1.909/1.971	2.154/2.012	2.183/2.445
		202	0		2.517/2.133	2.040/2.004	2.208/2.024	2.170/2.504
		204	0	2.269/3.493	2.621/2.340	2.258/2.101	2.264/2.088	2.186/2.646
		206	0	3.744/4.051	2.648/2.881	2.782/2.355	2.200/2.313	2.658/2.961
		208	0	4.842/5.407	2.615/2.326	3.198/2.992	4.037/3.028	4.680/3.641
		210	0		1.870/2.104	2.901/2.336		
		212	0		1.820/2.285			
	Po	196	2			1.802/1.567	2.039/1.683	2.292/2.055
		198	2			1.809/1.559	2.115/1.670	2.325/2.045
		200	2			1.812/1.556	2.135/1.659	2.261/2.045
		202	2					2.239/2.064
		204	2			2.042/1.597	1.651/1.666	2.227/2.123
		206	2			2.303/1.695		2.262/2.266
		208	2			2.884/1.948	2.369/1.955	2.800/2.582
		210	2		2.387/1.508	2.910/2.586	3.016/2.670	2.999/3.261
		214	2	2.148/1.974	1.275/1.146			
	Rn	204	4					2.219/1.856
		206	4					2.270/1.915
		208	4			2.179/1.476		2.319/2.058
		218	4		0.840/1.107			
		220	4	0.645/1.148	0.663/1.088			
		222	4	0.601/1.102	0.635/1.111			
	Ra	218	6		0.793/1.021	1.039/1.321	1.341/1.415	1.695/1.882
		220	6	0.413/1.094	0.474/0.981	0.634/1.205	0.872/1.326	1.162/1.709
		222	6	0.242/0.990	0.317/0.962			
		224	6	0.216/0.944	0.290/0.951	0.433/1.127	0.641/1.271	0.906/1.570
		226	6	0.254/0.921	0.322/0.943	0.446/1.112	0.627/1.257	0.858/1.540
		228	6	0.474/0.908	0.538/0.936	0.656/1.101		
		230	6	0.711/0.899	0.768/0.961	0.880/1.092		
	Th	220	8			0.994/1.254	1.329/1.366	1.719/1.814
		222	8		0.467/0.922	0.651/1.139	0.923/1.277	1.255/1.642
		224	8	0.248/0.935	0.305/0.902	0.464/1.087	0.699/1.241	0.996/1.553
		226	8	0.230/0.889	0.308/0.891	0.450/1.061	0.658/1.222	0.923/1.504
		228	8	0.328/0.866	0.396/0.883	0.519/1.046	0.695/1.209	0.921/1.473
		230	8	0.508/0.853	0.572/0.876	0.687/1.035	0.852/1.198	1.066/1.452
		232	8	0.714/0.844	0.774/0.861	0.884/1.026	1.043/1.188	1.250/1.436
		234	8	0.689/0.837				
	U	230	10	0.367/0.844	0.435/0.853	0.558/1.007	0.734/1.181	0.959/1.432
		232	10	0.563/0.832	0.629/0.847	0.747/0.997	0.915/1.170	1.131/1.411

(continued on next page)

(Table 2. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^-$	$J = 3^-$	$J = 5^-$	$J = 7^-$	$J = 9^-$
Pu	234	10	16	0.786/0.823	0.849/0.840	0.963/0.988	1.125/1.160	1.336/1.395
	236	10	18	0.688/0.816	0.744/0.835	0.848/0.980	1.000/1.150	1.199/1.381
	238	10	20	0.680/0.810	0.732/0.824	0.827/0.973	0.966/1.140	1.150/1.368
	238	12	18	0.605/0.805	0.661/0.818	0.763/0.957		
	240	12	20	0.597/0.799	0.649/0.813	0.742/0.949		
	242	12	22	0.780/0.794	0.832/0.807	0.927/0.942		
Cm	244	12	24		0.708/0.802	1.194/0.935		
	244	14	22		0.970/0.797			
	246	14	24	1.079/0.781	0.876/0.791	0.980/0.920	1.129/1.091	
	248	14	26	1.049/0.776	1.094/0.789	1.172/0.913		
Cf	248	16	24		0.630/0.784	0.735/0.908	0.885/1.080	1.781/1.284
	250	16	26	1.176/0.770	0.906/0.779	1.009/0.902	1.530/1.071	
	252	16	28		0.868/0.768			
Fm	256	18	28		0.923/0.768	1.045/0.880	1.214/1.045	

Table 3

Yrast energies of the unnatural parity even multipole states in even-even nuclei.

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^-$	$J = 4^-$	$J = 6^-$	$J = 8^-$	$J = 10^-$
He	4	0	0	21.84/20.20				
	6	0	2	13.90/14.97				
Be	6	2	0	26.00/15.36	23.00/19.50			
	8	2	2	18.91/12.15	20.90/15.37			
	10	2	2	6.263/10.56	9.270/13.07	10.57/17.30		
C	12	2	2	11.83/9.444	19.55/11.48			
	14	2	0	7.341/9.347	11.67/10.79	10.45/14.02		
	16	2	2	3.986/7.955				
O	16	0	0	8.872/9.039	14.30/10.17			
	18	0	2	5.530/7.775	7.977/8.962	11.06/11.38		
	20	0	4	6.555/6.946				
Ne	20	2	2	4.967/6.998	7.004/8.091	10.61/10.32	15.70/15.34	
	22	2	4	5.146/6.239		11.13/9.288		
Mg	22	4	2	5.006/6.399				
	24	4	4	8.864/5.693				
	26	4	6	7.261/5.213	7.283/6.138	8.464/7.853		
	28	4	4	5.470/5.189			14.64/10.91	
Si	28	6	6	8.953/4.816	8.413/5.682	11.58/7.308		
	30	6	4	6.641/4.821	6.503/5.594	9.111/7.125		
	32	6	2	5.220/5.031	5.220/5.653			
S	32	4	4	6.224/4.796	6.621/5.498	8.346/6.903		
	34	4	2	5.323/5.026	6.421/5.583	7.392/6.949		
	36	4	0	5.509/5.616	5.022/5.874			
	38	4	2	3.516/4.740	3.725/5.213	3.725/6.438		
	40	4	4	4.138/4.220				
Ar	36	2	2	4.974/5.111	5.896/5.592	7.354/6.845		
	38	2	0	5.084/5.715	4.480/5.902	7.070/7.209	8.809/9.332	9.929/11.34
	40	2	2	4.229/4.851	4.226/5.257	6.013/6.383	6.979/8.477	
	42	2	4	2.513/4.341	2.513/4.811			
Ca	40	0	0	6.025/5.934	5.614/6.025	7.422/7.229	8.851/9.206	13.20/11.65
	42	0	2	4.342/5.081	3.954/5.394	5.491/6.422	5.927/8.385	7.369/10.58
	44	0	4	3.676/4.580	3.712/4.960	5.655/5.894		
	48	0	0	5.311/5.528	5.145/5.509	7.953/6.519	9.295/8.066	
Ti	44	2	2	3.415/4.632	3.646/4.978	5.152/5.999	6.924/7.855	8.862/9.517
	46	2	4	3.677/4.139	3.441/4.554	4.417/5.485	6.151/7.253	7.961/8.784
	48	2	2	3.803/4.445	3.782/4.741	4.956/5.673	5.545/7.336	6.102/8.919
	50	2	0	4.173/5.101	4.147/5.121			
Cr	48	4	4	3.524/3.814	3.534/4.237	4.876/5.164		
	50	4	2	3.895/4.126	4.070/4.432			
	52	4	0	8.790/4.787	5.285/4.819	8.420/5.835	8.100/7.220	6.365/8.809
	54	4	2	3.393/3.974				7.895/7.881
Fe	54	2	0	3.437/4.949			8.319/6.897	
	56	2	2	3.760/4.141	3.760/4.360	3.760/4.873		5.402/7.544
	58	2	4	4.438/3.681	4.440/3.980			7.242/6.924
	64	6	10			3.529/3.759		
Ni	58	0	2	3.269/4.421				
	60	0	4	4.335/3.964		5.149/4.238	7.937/5.958	9.344/7.294
	62	0	6	3.262/3.695	3.462/3.931	4.863/3.946	5.110/5.470	6.951/6.686
	64	0	8	3.464/3.527	3.797/3.749	4.172/3.744	5.806/5.101	
	66	8	10			3.599/3.594		
	68	0	10		3.173/3.555	3.444/3.513		

(continued on next page)

(Table 3. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^-$	$J = 4^-$	$J = 6^-$	$J = 8^-$	$J = 10^-$
Zn	60	2	2	3.972/4.016				
	62	10	4			5.130/4.087	6.113/5.253	7.423/6.491
	64	2	6	3.196/3.297	3.285/3.581	3.465/3.801	5.624/4.894	7.062/6.072
	66	2	8	2.763/3.132		4.076/3.604	5.112/4.616	
	68	2	10	4.670/3.023	4.124/3.272	3.611/3.459	3.943/4.395	4.866/5.525
	70	2	10		3.246/3.215			
Ge	64	12	4					6.607/6.318
	66	4	6		2.726/3.315			
	68	4	8		2.901/3.140	3.883/3.485	4.958/4.443	6.421/5.609
	70	4	10	3.335/2.741	3.372/3.012	3.667/3.345	4.852/4.229	
	72	4	10	3.036/2.697	3.937/2.958	3.688/3.271	3.668/4.121	
	74	4	8	3.424/2.716	3.060/2.978	3.060/3.264		
	76	4	6	2.748/2.789	2.655/3.045	3.195/3.309		
	78	4	4	1.644/2.963				
Se	70	14	8			3.788/3.383	4.410/4.290	
	72	6	10	1.876/2.536	1.876/2.813	3.522/3.246		
	74	6	10	2.478/2.494	2.832/2.761	3.253/3.176	4.198/3.980	5.209/5.120
	76	6	8	1.881/2.515	2.860/2.784	3.226/3.173	4.009/3.982	5.068/5.094
	78	6	6	2.560/2.590	2.743/2.852	3.014/3.220	4.048/4.038	
	80	6	4	3.199/2.765				
	82	6	2	4.566/3.126				
Kr	74	8	10		2.656/2.657	3.139/3.176	3.840/3.980	4.721/5.120
	76	8	10	1.598/2.344	1.598/2.608	3.175/3.110	3.902/3.883	4.808/5.002
	78	8	8		2.656/2.633	3.220/3.109	3.840/3.890	4.809/4.982
	80	8	6		2.793/2.703	3.042/3.160	4.126/3.950	5.159/5.029
	82	8	4	2.450/2.620	2.648/2.847	3.038/3.297	4.171/4.088	5.325/5.181
	84	8	2	3.706/2.982	3.408/3.106	3.587/3.586	4.388/4.340	5.641/5.506
	86	8	0	4.040/3.690	4.040/3.553	4.040/4.139		6.248/6.113
	88	8	2	4.268/2.919				
	92	8	6	0.769/2.253				
Sr	80	10	8	2.493/2.254	2.836/2.513	3.314/3.074	4.057/3.840	4.923/4.879
	82	10	6		2.824/2.586	3.086/3.127	4.033/3.905	4.909/4.931
	84	12	4			3.279/3.267	4.268/4.047	
	86	10	2		3.500/2.992			
	88	10	0	4.514/3.583		4.020/4.114	5.371/4.726	7.129/6.028
	90	10	2	2.497/2.814		3.720/3.459	3.720/4.162	
	92	10	4	1.778/2.389				
	94	10	6	2.604/2.150	2.604/2.366			
	96	10	8	2.151/2.010				
	98	10	10	1.224/1.923	1.978/2.117			
Zr	100	12	12			1.975/2.494		
	82	10	8		2.692/2.471	3.128/3.053	3.947/3.809	4.908/4.786
	84	10	6		2.811/2.545	3.079/3.109	4.037/3.878	4.869/4.842
	86	10	4	2.042/2.479		3.272/3.251	4.134/4.024	5.067/5.004
	88	10	2		2.990/2.955	3.214/3.544	4.388/4.283	4.713/5.337
	90	10	0	4.992/3.553	2.739/3.404	4.232/4.102		6.376/5.951
	92	10	2	2.473/2.785	3.192/2.885		3.819/4.148	
	94	10	4	2.699/2.361				
	96	10	6		3.586/2.334			
	98	10	8	2.479/1.984	2.479/2.189			
	100	10	10	1.295/1.899				
	102	10	12		1.821/2.015	2.175/2.493	2.666/2.992	
Mo	86	8	6			2.960/3.109	3.749/3.872	4.661/4.770
	90	8	2	2.528/2.889				4.789/5.273
	92	8	0	3.621/3.600	3.621/3.445	4.685/4.109		5.152/5.891
	94	8	2	3.072/2.833	2.835/2.927		3.805/4.155	3.805/5.113
	96	8	4	2.790/2.410	2.790/2.595			
	98	8	6	1.881/2.173	1.881/2.379	2.571/2.834	2.571/3.484	
	100	8	8	2.190/2.035	2.190/2.234			
	102	8	10			3.220/2.582		3.370/3.906
	104	8	12		2.061/2.063		2.864/3.010	
	106	8	14		1.937/2.010	2.143/2.453	2.629/2.917	3.238/3.690

(continued on next page)

(Table 3. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^-$	$J = 4^-$	$J = 6^-$	$J = 8^-$	$J = 10^-$
	108	8	16			2.556/2.407	3.797/2.839	
Ru	94	6	0		2.503/3.517			
	96	6	2	3.210/2.916	2.462/3.000	2.794/3.492	3.363/4.189	4.534/5.089
	98	6	4	2.375/2.495	2.375/2.669			
	100	6	6	2.469/2.258	2.325/2.454	2.325/2.872	3.218/3.523	3.992/4.270
	102	6	8	2.261/2.121	2.303/2.311	2.650/2.722	2.940/3.322	3.538/4.050
	104	6	10	2.329/2.037	2.269/2.212	1.975/2.622	2.928/3.171	3.473/3.893
	106	6	12	2.946/1.982		2.486/2.551	2.871/3.056	3.423/3.775
	108	6	14	2.125/1.943		2.273/2.496	2.716/2.964	3.294/3.681
Pd	96	4	0	2.391/3.817	2.391/3.631	3.725/4.212	3.725/4.812	
	100	4	4	2.622/2.631	2.055/2.786	3.022/3.180	3.879/3.873	4.635/4.649
	102	4	6	2.249/2.395	2.295/2.571	2.914/2.947	3.671/3.598	4.318/4.328
	104	4	8	1.999/2.259	2.299/2.429	2.715/2.799	2.901/3.399	3.770/4.110
	106	4	10	1.904/2.175	2.306/2.331	2.699/2.700	2.999/3.250	3.654/3.955
	108	4	12		2.531/2.262	2.709/2.629	3.089/3.136	3.727/3.839
	110	4	14	2.193/2.083	3.570/2.210	3.570/2.576		
	114	4	14		2.065/2.163	2.520/2.512	3.048/2.959	
	116	4	12		1.532/2.167	2.276/2.502	2.825/2.962	
	118	4	10		1.871/2.190	2.543/2.508		
Cd	104	2	6			2.844/3.074	4.155/3.720	4.810/4.563
	106	2	8	2.890/2.471	2.522/2.606	3.320/2.928	3.094/3.523	3.902/4.348
	108	2	10	2.820/2.389	2.810/2.509	2.975/2.830	3.224/3.376	3.872/4.195
	110	2	12	2.405/2.336		2.896/2.761	3.056/3.264	3.823/4.081
	112	2	14	2.667/2.298	2.507/2.389	2.818/2.708	3.093/3.175	3.810/3.992
	114	2	16	2.580/2.269	2.461/2.349	2.413/2.665		
	116	2	14	2.294/2.259	2.340/2.343	2.828/2.646		
	118	2	12	3.182/2.258	2.223/2.349			
	124	2	6		2.682/2.517			
Sn	108	0	8				4.146/3.709	5.141/5.013
	110	0	10	2.121/2.712	2.821/2.767		3.765/3.565	4.317/4.863
	112	0	12	2.557/2.659			3.431/3.454	4.583/4.751
	114	0	14	3.025/2.622	3.363/2.649	3.244/2.917	3.190/3.367	4.671/4.663
	116	0	16	3.289/2.594	3.158/2.609	3.273/2.875	3.228/3.296	4.496/4.591
	118	0	14	3.015/2.584	2.774/2.604	2.817/2.857	3.559/3.286	
	120	0	12	3.548/2.584	2.696/2.611	2.750/2.848	3.446/3.292	
	122	0	10	4.180/2.599	2.651/2.634	2.651/2.856	3.417/3.321	
	124	0	8	3.267/2.642	2.614/2.685	2.568/2.892	3.011/3.384	
	126	0	6	2.111/2.739		2.478/2.977		
	128	0	4	2.274/2.935			2.413/3.685	
	130	0	2	3.167/3.315	2.215/3.230			
	132	0	0		4.831/3.698	6.173/4.048	6.896/4.446	
Te	110	2	8			2.576/2.859	3.221/3.429	4.168/4.230
	112	2	10				3.454/3.286	4.109/4.081
	114	2	12				3.279/3.177	4.062/3.971
	116	2	14		2.119/2.343	2.966/2.646	3.175/3.091	3.752/3.885
	118	2	16			3.000/2.605	3.189/3.022	3.881/3.814
	120	2	14	3.052/2.223	2.461/2.300	2.878/2.588	3.142/3.013	3.814/3.785
	122	2	12	2.558/2.222	2.536/2.307	2.759/2.581	3.074/3.020	3.746/3.771
	124	2	10	2.702/2.238	2.512/2.331	2.590/2.590	3.272/3.050	3.872/3.781
	126	2	8	2.045/2.282	2.386/2.383	2.396/2.626	3.194/3.115	
	128	2	6		2.396/2.479	2.762/2.712		
	130	2	4	3.568/2.575	2.436/2.647	2.405/2.882	2.878/3.418	
	132	2	2			2.422/3.202		
	134	2	0		4.270/3.397	4.270/3.785	4.563/4.181	5.658/5.193
	136	2	2	1.905/2.927				
Xe	114	4	10			2.766/2.568	3.095/3.070	3.638/3.727
	116	4	12			2.607/2.502	3.079/2.962	3.633/3.619
	120	4	16	1.995/1.978	2.187/2.080	2.545/2.412	2.967/2.810	3.383/3.465
	122	4	14	1.716/1.970			3.009/2.803	3.562/3.438
	124	4	12	2.791/1.970	2.223/2.084	2.509/2.389	2.810/2.811	3.462/3.425
	126	4	10	2.229/1.986	2.259/2.109	2.562/2.399	2.758/2.842	3.446/3.436
	128	4	8	2.253/2.031	2.166/2.161	2.501/2.436	2.787/2.907	3.594/3.486

(continued on next page)

(Table 3. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^-$	$J = 4^-$	$J = 6^-$	$J = 8^-$	$J = 10^-$
Ba	130	4	6	2.296/2.128	2.103/2.258	2.346/2.522	2.842/3.023	3.542/3.597
	132	4	4		2.353/2.426	2.353/2.693	2.828/3.212	
	134	4	2	2.116/2.706	2.116/2.709			
	138	4	2	1.866/2.677				
	122	6	16			2.298/2.271	2.664/2.645	3.118/3.293
	124	6	14		2.034/1.911	2.359/2.256	2.705/2.638	3.157/3.267
	126	6	12	2.872/1.793	2.056/1.919	2.408/2.250	2.773/2.648	3.237/3.256
	128	6	10		1.800/1.944		2.613/2.680	3.293/3.269
	130	6	8	2.891/1.854	2.891/1.997		2.475/2.746	3.435/3.319
	132	6	6	2.505/1.952	2.027/2.094	2.358/2.385	2.901/2.863	3.659/3.432
	134	6	4	2.280/2.149	2.662/2.263	2.377/2.557		
	136	6	2	2.544/2.530	2.544/2.546	2.299/2.878		
Ce	138	6	0	3.376/3.256	3.561/3.015		3.678/3.821	
	140	6	2	2.871/2.503				5.101/3.956
	144	6	6	1.316/1.868		1.991/2.254	2.363/2.691	
	146	6	8			1.874/2.123	2.090/2.517	2.389/3.022
	128	8	12		1.980/1.796	2.333/2.146	2.700/2.519	3.130/3.162
	130	8	10			2.381/2.157	2.643/2.553	3.072/3.175
	132	8	8		2.039/1.875	2.469/2.196	2.341/2.620	3.172/3.227
	134	8	6	1.904/1.827		2.359/2.284	2.896/2.737	3.405/3.341
	136	8	4	2.826/2.024		2.425/2.456	3.147/2.929	3.987/3.557
	138	8	2	2.950/2.406	2.950/2.425	2.765/2.778	4.157/3.231	
	140	8	0	3.912/3.132	3.395/2.895		3.477/3.698	
	142	8	2	2.728/2.379	2.384/2.394			
Nd	144	8	4	3.060/1.970	2.127/2.079			
	146	8	6	1.989/1.745				
	148	8	8			1.682/2.026	1.953/2.397	2.306/2.938
	132	10	10			2.346/2.080	2.698/2.451	3.110/3.113
	134	10	8			2.413/2.120	2.293/2.519	3.182/3.166
	136	10	6		2.228/1.880	2.484/2.208	2.758/2.637	3.244/3.281
	140	10	2				3.239/3.133	4.031/3.883
	142	10	0	3.831/3.043	3.245/2.804		3.456/3.600	4.606/4.548
	144	10	2	2.946/2.291	2.205/2.304	2.716/2.662		3.803/3.813
	146	10	4		2.046/1.989			3.246/3.358
	148	10	6	2.931/1.658				
	150	10	8	1.182/1.532	1.308/1.659			
	152	10	10	1.542/1.459	1.693/1.574			
Sm	154	10	12	1.003/1.415	1.128/1.517	1.326/1.819	1.594/2.090	1.933/2.675
	136	12	8				2.265/2.437	3.112/3.119
	138	12	6		1.656/1.810	2.258/2.149		
	140	12	4	1.420/1.870		2.959/2.323	2.959/2.750	
	142	12	2		2.416/2.265		3.113/3.053	3.974/3.839
	144	12	0	2.804/2.979	3.119/2.735	3.266/3.231	3.377/3.522	4.701/4.504
	146	12	2		2.046/2.235	2.826/2.605	3.167/3.001	3.754/3.771
	148	12	4	1.689/1.818	2.031/1.920	2.699/2.242	2.943/2.645	3.253/3.316
	150	12	6	1.658/1.594	1.773/1.720		2.589/2.399	2.929/3.029
	152	12	8	1.530/1.468	1.682/1.592	1.891/1.899	2.056/2.227	2.309/2.845
	154	12	10	1.515/1.396	1.662/1.507			
	156	12	12	1.010/1.352	1.144/1.450	1.511/1.764		
	158	12	14			1.391/1.727	1.671/1.949	
Gd	138	14	8				2.233/2.370	3.043/3.078
	142	14	4					3.305/3.413
	144	14	2		2.331/2.211	3.015/2.600	3.018/2.988	3.910/3.801
	146	14	0		2.997/2.681	3.099/3.186	3.182/3.458	4.248/4.467
	148	14	2	2.504/2.178	1.913/2.182	2.567/2.561	3.030/2.937	3.667/3.734
	150	14	4	1.947/1.770	1.947/1.867			3.220/3.280
	152	14	6	1.643/1.547		2.173/1.984		
	154	14	8	1.398/1.422	1.560/1.539		2.183/2.165	2.580/2.811
	156	14	10	1.320/1.349	1.469/1.455	1.706/1.775	2.028/2.044	2.427/2.688
	158	14	12	1.024/1.306	1.159/1.398	1.372/1.722		
	140	16	8				2.166/2.314	
	148	16	0		2.995/2.639	2.854/3.149	3.405/3.404	

(continued on next page)

(Table 3. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^-$	$J = 4^-$	$J = 6^-$	$J = 8^-$	$J = 10^-$
	150	16	2			2.583/2.524	2.583/2.885	3.243/3.701
	152	16	4	1.841/1.734			2.727/2.530	3.161/3.248
	154	16	6	1.635/1.511	1.819/1.627		2.192/2.285	
	156	16	8			1.899/1.820	2.262/2.114	2.580/2.779
	158	16	10	1.372/1.314	1.518/1.415			2.478/2.658
	160	16	12	1.265/1.271	1.386/1.358	1.594/1.688	1.882/1.906	
	162	16	14	1.148/1.243	1.297/1.319	1.530/1.651	1.808/1.840	2.111/2.513
	164	16	16	0.977/1.223	1.123/1.290	1.346/1.624		
	166	16	18	1.030/1.208	1.181/1.268			
	166	16	18					
Er	148	14	2				2.706/2.937	
	150	14	0			2.854/3.148		
	156	14	6	1.631/1.524	1.814/1.641	2.206/1.948	2.603/2.291	2.905/2.934
	158	14	8	1.526/1.399	1.743/1.514		2.333/2.121	2.570/2.752
	160	14	10		1.638/1.430	1.908/1.741	2.294/2.000	2.532/2.631
	162	14	12	1.420/1.284	1.543/1.374	1.761/1.689	2.062/1.913	2.429/2.548
	164	14	14	2.003/1.256	1.610/1.334	1.744/1.652	1.964/1.848	2.261/2.487
	166	14	16	1.458/1.237	1.572/1.306	1.787/1.625	2.073/1.799	2.428/2.440
	168	14	18	1.404/1.222	1.094/1.284	1.311/1.603	1.606/1.759	
	170	14	20	1.305/1.209	1.269/1.266	1.496/1.585		
Yb	158	12	6			2.230/1.956	2.650/2.307	2.923/2.909
	160	12	8	1.525/1.423	1.568/1.540	2.051/1.829	2.363/2.137	2.579/2.727
	162	12	10				2.280/2.017	2.572/2.607
	164	12	12	1.416/1.309	1.416/1.401	1.798/1.698	2.123/1.931	2.483/2.524
	166	12	14	1.503/1.281	1.617/1.362	1.835/1.662	2.072/1.866	2.361/2.464
	168	12	16	1.650/1.262	1.650/1.333	1.842/1.635	2.100/1.817	2.426/2.418
	170	12	18	1.425/1.247	1.258/1.312	1.450/1.614	1.716/1.778	2.057/2.381
	172	12	20	1.198/1.235	1.331/1.294	1.541/1.595	1.810/1.747	2.145/2.349
	174	12	22	1.318/1.224	1.468/1.280	2.021/1.579	2.496/1.720	
	176	12	20	1.132/1.216	1.283/1.273		1.050/1.711	
Hf	160	10	6					2.964/2.890
	162	10	8		1.735/1.582	2.118/1.849	2.439/2.168	2.623/2.708
	164	10	10			1.947/1.770	2.302/2.049	2.576/2.589
	166	10	12		1.551/1.443	1.841/1.719	2.197/1.963	2.540/2.507
	168	10	14	1.160/1.323	1.407/1.404	1.813/1.683	2.156/1.899	2.467/2.447
	170	10	16			1.800/1.657	2.109/1.850	2.477/2.402
	172	10	18	1.496/1.289	1.419/1.355	1.598/1.636	1.739/1.812	2.186/2.365
	174	10	20	1.307/1.277	1.425/1.338	1.634/1.617	1.798/1.780	2.279/2.333
	176	10	22	1.248/1.266	1.405/1.323	1.653/1.601	1.559/1.754	2.031/2.305
	178	10	20	1.260/1.259	1.409/1.317	1.649/1.590	1.147/1.745	1.601/2.287
W	180	10	18	1.354/1.253	1.374/1.313	1.612/1.580	1.142/1.741	1.654/2.272
	182	10	16				1.173/1.745	
	166	8	10			2.020/1.808	2.350/2.099	2.573/2.584
	168	8	12		1.578/1.507	1.916/1.757	2.318/2.013	2.621/2.502
	170	8	14	1.328/1.388	1.493/1.468	1.811/1.722	2.204/1.950	2.552/2.443
	172	8	16		1.434/1.440	1.713/1.696	2.074/1.902	2.476/2.398
	174	8	18		1.365/1.419	1.629/1.675	1.963/1.864	2.330/2.362
	176	8	20	1.128/1.343	1.302/1.402	1.576/1.657	1.925/1.833	2.308/2.331
	178	8	22	1.045/1.333	1.225/1.388	1.509/1.641	1.827/1.806	2.133/2.304
	180	8	20	1.006/1.325	1.185/1.382	1.462/1.630	1.529/1.798	1.945/2.285
Os	182	8	18	1.289/1.319	1.488/1.379	1.769/1.620	2.114/1.795	2.564/2.271
	184	8	16	1.130/1.316	1.345/1.379	1.446/1.613		
	186	8	14	0.953/1.317	1.172/1.387		1.738/1.812	2.286/2.260
	188	8	12	0.854/1.326	0.854/1.405	1.534/1.620		
	190	8	10					2.381/2.309
	166	6	8			2.426/1.949	3.026/2.293	
	172	6	14		1.728/1.562	2.061/1.785	2.415/2.026	2.635/2.470
	174	6	16		1.550/1.534	1.790/1.759	2.103/1.978	2.477/2.426
	176	6	18		1.475/1.514	1.708/1.738	2.021/1.941	2.395/2.390
	178	6	20		1.470/1.497	1.707/1.721	2.018/1.910	2.384/2.359
	180	6	22		1.515/1.483	1.761/1.705	1.986/1.884	2.274/2.332
	182	6	20		1.627/1.477	1.756/1.694	1.832/1.876	2.220/2.315
	184	6	18		1.621/1.474	1.833/1.685		
	186	6	16			1.772/1.679	1.968/1.877	2.431/2.291
	186	6	16					
	186	6	16					

(continued on next page)

(Table 3. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^-$	$J = 4^-$	$J = 6^-$	$J = 8^-$	$J = 10^-$
Pt	188	6	14	1.463/1.418			1.994/1.891	
	190	6	12	1.327/1.428	1.584/1.500			1.705/2.304
	192	6	10	1.941/1.452	1.561/1.535			2.015/2.340
	176	4	16		1.736/1.670	2.004/1.858	2.320/2.089	2.689/2.526
	178	4	18			1.810/1.838	2.119/2.051	2.496/2.491
	180	4	20			1.815/1.821	2.107/2.021	2.444/2.461
	182	4	22			1.844/1.805	2.079/1.996	2.424/2.434
	184	4	20				1.839/1.988	
	186	4	18		1.633/1.610	1.970/1.785	2.195/1.986	2.559/2.403
	188	4	16				2.180/1.990	2.701/2.395
	190	4	14	1.877/1.571	1.626/1.619	1.834/1.779	2.078/2.004	2.297/2.395
	192	4	12	1.667/1.581	1.667/1.637	1.746/1.787	1.965/2.034	2.172/2.408
	194	4	10	1.888/1.605	1.888/1.672	1.784/1.811	2.000/2.085	2.310/2.445
	196	4	8	2.420/1.658	1.957/1.735	1.680/1.862	1.902/2.170	2.162/2.518
	200	4	4		1.908/2.019	1.908/2.145		
Hg	178	2	16		1.851/1.863	2.215/2.009		
	180	2	18			1.870/1.989	2.369/2.208	2.742/2.768
	186	2	20			2.186/1.946	2.217/2.146	2.592/2.696
	188	2	18	1.719/1.800	2.077/1.804	2.295/1.938	2.449/2.144	2.784/2.683
	190	2	16		2.319/1.805	2.251/1.932	2.319/2.148	2.724/2.674
	192	2	14		1.845/1.813	1.987/1.931	2.216/2.163	2.633/2.675
	194	2	12	1.958/1.808	1.958/1.832	2.165/1.940	2.138/2.193	2.562/2.689
	196	2	10	1.986/1.833		2.058/1.964	2.098/2.245	2.554/2.725
	198	2	8			1.910/2.015		
	200	2	6	2.074/1.992		2.049/2.115	2.135/2.464	2.523/2.934
	202	2	4	2.280/2.197	2.293/2.214			
	204	2	2	1.717/2.585	2.761/2.506	2.724/2.632	2.724/2.990	2.724/3.575
Pb	188	0	20			1.789/2.174	2.218/2.365	
	192	0	16				2.507/2.368	3.175/3.380
	194	0	14	1.637/2.135	1.637/2.087	2.299/2.160	2.419/2.383	3.207/3.381
	196	0	12	1.992/2.144	2.471/2.106		2.334/2.413	3.281/3.395
	198	0	10		2.099/2.141	2.099/2.193		
	200	0	8			2.257/2.244	2.699/2.550	
	202	0	6		2.360/2.311	2.289/2.344		
	204	0	4	2.400/2.533	2.338/2.489	2.434/2.528		2.945/3.879
	206	0	2	3.194/2.922	2.826/2.781	2.384/2.862	2.955/3.211	7.350/4.283
	208	0	0	4.230/3.655	3.475/3.259	3.920/3.458	4.830/3.694	4.830/4.966
Po	194	2	16					2.656/2.635
	198	2	12				2.288/2.164	2.813/2.651
	200	2	10		2.221/1.850	2.221/1.941	2.236/2.217	
	202	2	8		2.485/1.913	2.485/1.993	2.194/2.302	
	204	2	6			1.651/2.093		2.828/2.898
	206	2	4					2.432/3.135
	208	2	2	1.995/2.571		2.575/2.612		
	210	2	0	3.024/3.304	3.075/2.968	3.125/3.208	3.138/3.447	3.183/4.223
Rn	214	2	4	1.995/2.156				
	202	4	10	1.030/1.576				
	204	4	8					2.461/2.445
	206	4	6	1.502/1.735				2.476/2.581
Ra	208	4	4			2.330/2.103		2.618/2.818
	218	6	4		1.573/1.805			
	222	6	8	1.433/1.409				
	224	6	10	1.090/1.342				
	226	6	12	1.071/1.304				
	228	6	14	1.042/1.280				
Th	232	6	18		0.849/1.287	0.849/1.435		
	228	8	12	1.123/1.188	1.060/1.250			
	230	8	14	0.972/1.164	1.197/1.216			
	232	8	16		1.143/1.193			
U	232	10	14	1.017/1.083	1.098/1.135			

(continued on next page)

(Table 3. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 2^-$	$J = 4^-$	$J = 6^-$	$J = 8^-$	$J = 10^-$
Pu	234	10	16	0.989/ 1.068	1.069/ 1.112	1.195/ 1.302	1.568/ 1.413	
	236	10	18	0.988/ 1.058	1.053/ 1.095	1.164/ 1.287	1.320/ 1.383	
	238	10	20	0.950/ 1.050	1.028/ 1.083	1.151/ 1.275	1.318/ 1.360	1.528/ 1.767
	236	12	16	1.341/ 1.011				
	238	12	18	0.968/ 1.001	1.083/ 1.035			
Pu	240	12	20	0.959/ 0.993	1.038/ 1.023	1.162/ 1.231		
	242	12	22	1.151/ 0.986	1.064/ 1.013			
	244	12	24				1.216/ 1.266	
	244	12	24					
Cm	244	14	22	1.106/ 0.946				
	246	14	24	0.842/ 0.940	0.923/ 0.960	1.051/ 1.179	1.179/ 1.218	
Cf	248	16	24	0.592/ 0.911	0.677/ 0.926	0.806/ 1.154	0.979/ 1.181	
	250	16	26	0.872/ 0.905	0.952/ 0.919	1.070/ 1.146		
	252	16	28	0.831/ 0.900	0.917/ 0.913			
Fm	256	18	30	0.882/ 0.874	0.979/ 0.882			

Table 4

Yrast energies of the unnatural parity odd multipole states in even-even nuclei.

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^+$	$J = 3^+$	$J = 5^+$	$J = 7^+$	$J = 9^+$
He	4	0	0	28.31/20.22				
Be	8	2	2	17.64/12.26	19.07/11.42			
	10	2	2	10.57/10.63				
C	12	2	2	12.71/9.468				
	14	2	0	10.45/9.214				
	16	2	2		4.088/7.231			
O	16	0	0	13.66/8.943	11.08/8.737	14.40/11.20		
	18	0	2	8.817/7.758	5.378/7.517			
	22	0	6		4.582/6.168			
Ne	18	2	0		4.561/7.414			
	20	2	2	9.935/6.873	9.873/6.287			
	22	2	4	5.332/6.250	5.641/5.559	7.422/7.800	11.13/10.49	
Mg	22	4	2	5.006/6.388	5.006/5.678	5.293/7.835		
	24	4	4	7.748/5.819	5.235/5.003	7.812/7.067		
	26	4	6	5.691/5.440	3.942/4.544	6.978/6.477	9.829/8.723	
	28	4	4	4.560/5.266				
	30	4	2	3.461/5.267	3.461/4.680			
	32	4	0	2.551/5.686				
Si	26	6	4		13.08/4.661			
	28	6	6	8.328/5.161	6.276/4.235	8.945/6.009	12.99/8.054	
	30	6	4	3.770/5.017	4.831/4.229	7.001/5.883		
	32	6	2	5.220/5.041	5.220/4.420			
S	30	4	6	3.676/4.952				
	32	4	4	4.695/4.831	5.413/4.129	7.567/5.724		
	34	4	2	4.075/4.877	4.877/4.338	7.392/5.775		
	36	4	0	4.523/5.333	5.462/4.895			
	38	4	2	3.516/4.556	3.725/4.061	3.725/5.357		
	40	4	4	3.489/4.185				
Ar	36	2	2	5.194/4.801	6.646/4.446	9.682/5.815		
	38	2	0	5.552/5.272	6.485/5.015	7.528/6.092	8.809/7.882	9.929/9.732
	40	2	2	4.229/4.508	4.229/4.194	5.143/5.436		
	42	2	4	2.513/4.149	2.513/3.712			
Ca	40	0	0	6.938/5.552	6.030/5.700	7.397/6.493	8.980/8.136	11.71/9.940
	42	0	2	4.232/4.799	4.000/4.888	5.725/5.853	5.927/7.346	8.083/8.671
	44	0	4	3.662/4.449	3.357/4.416	3.923/5.407		
	46	0	2	13.02/4.569				
	48	0	0	4.695/5.091	4.612/5.308	5.145/5.910	9.366/7.329	
	50	0	2	4.035/4.371				
Ti	44	2	2	7.216/4.260	3.415/3.982			
	46	2	4	3.731/3.919	11.35/3.518			
	48	2	2	4.197/4.047	4.197/3.802	4.046/4.853	5.169/6.261	6.034/7.383
	50	2	0	4.940/4.576	3.863/4.423	5.441/5.210		
	54	2	4				5.111/5.456	6.187/6.401
Cr	48	4	4	3.524/3.725	3.524/3.179	4.766/4.298	4.513/5.622	6.258/6.725
	50	4	2	3.630/3.859	3.595/3.469	3.792/4.475		
	52	4	0	3.740/4.394	3.472/4.096	3.616/4.839	5.397/6.216	6.453/7.671
	54	4	2	3.720/3.686	5.291/3.324	3.786/4.261	5.086/5.513	6.446/6.515
Fe	50	6	4					
	54	2	0	5.080/4.402	3.345/4.278	3.794/4.996	5.927/6.365	6.724/7.758
	56	2	2	3.120/3.699	3.445/3.511	3.760/4.424	4.701/5.672	
	58	2	4	2.782/3.394	2.134/3.078			6.282/6.067
	60	2	6			3.516/3.770	3.959/4.868	
	64	2	10	1.444/3.067			3.529/4.440	

(continued on next page)

(Table 4. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^+$	$J = 3^+$	$J = 5^+$	$J = 7^+$	$J = 9^+$
Ni	58	0	2	2.902/4.044	3.420/4.254	4.384/4.916	5.664/6.055	7.446/6.988
	60	0	4	3.194/3.744	2.626/3.825	4.165/4.535	5.785/5.591	6.673/6.451
	62	0	6	3.270/3.592	3.462/3.574	4.160/4.272	4.649/5.266	5.751/6.155
	64	0	8	2.972/3.498	3.482/3.418	4.285/4.083		
	66	0	10		2.671/3.314			
	68	0	10		4.166/3.268			
Zn	60	2	2		5.337/3.391	4.200/4.249		
	62	2	4		2.385/2.965	5.123/3.874	5.123/4.976	7.976/5.774
	64	2	6	3.071/3.109	2.980/2.717	3.539/3.615	4.823/4.658	
	66	2	8	3.229/3.018	3.686/2.564	3.709/3.430		
	68	2	10	3.184/2.950	3.935/2.463	4.345/3.292		
	70	2	10	2.949/2.896	2.949/2.419	3.598/3.228		
	74	2	6	2.148/2.838				
Ge	66	4	6			3.023/3.284		
	68	4	8	3.087/2.869	2.429/2.266	3.631/3.103	5.267/4.045	5.874/4.908
	70	4	10	3.242/2.804	2.451/2.167		5.299/3.875	
	72	4	10	2.950/2.752	2.065/2.125	3.250/2.907		
	74	4	8	2.404/2.715	1.697/2.140	3.060/2.921		3.242/4.587
	76	4	6	2.205/2.699	1.539/2.205	3.053/2.980		
	78	4	4		1.644/2.365			
Se	70	6	8		2.518/2.142			4.954/4.657
	72	6	10		2.586/2.045			
	74	6	10	2.379/2.683	1.884/2.006	2.662/2.734	3.525/3.549	4.450/4.424
	76	6	8	1.881/2.647	1.689/2.022	2.489/2.750	3.432/3.559	4.405/4.352
	78	6	6	2.300/2.634	1.854/2.090	2.735/2.812	3.704/3.623	4.857/4.321
	80	6	4	2.344/2.675	2.121/2.251			
	82	6	2	4.566/2.864	2.550/2.589			
Kr	74	8	10	4.244/2.678	1.941/1.981	2.613/2.682	3.452/3.453	
	76	8	10	1.598/2.631	1.598/1.943	2.452/2.627	3.332/3.379	4.403/4.257
	78	8	8	4.244/2.598	1.941/1.961	2.613/2.646	3.452/3.392	
	80	8	6		1.788/2.030	2.660/2.711	3.635/3.460	
	82	8	4	2.450/2.630	2.094/2.193	3.187/2.847	3.709/3.613	5.012/4.233
	84	8	2	3.366/2.820	2.861/2.533	3.289/3.097		4.976/4.539
	86	8	0	3.010/3.406	2.850/3.204	3.010/3.528	4.277/4.403	5.815/5.433
	88	8	2	2.828/2.745	2.342/2.473			
	92	8	6	1.446/2.360				
Sr	80	10	8	2.493/2.554	1.571/1.919	2.296/2.573	3.173/3.270	4.170/4.066
	82	10	6		1.689/1.989	2.526/2.640	3.477/3.341	4.493/4.043
	84	10	4		2.057/2.154	2.736/2.778	3.158/3.496	4.371/4.117
	86	10	2	7.822/2.781	4.146/2.494	3.775/3.030		4.148/4.426
	88	10	0	3.378/3.369	4.227/3.166	4.873/3.464	5.370/4.292	7.129/5.324
	90	10	2		2.497/2.437			
	92	10	4	2.141/2.444				
	94	10	6		2.604/1.816			
	96	10	8	1.995/2.263	2.151/1.687		3.329/2.831	3.525/3.487
	98	10	10	1.224/2.221	1.682/1.608	1.978/2.138		
	100	10	12	1.257/2.187	1.414/1.555			
Zr	82	10	8		1.449/1.885	2.175/2.526	3.068/3.207	4.086/3.982
	84	10	6		1.576/1.957	2.335/2.594	3.202/3.280	4.138/3.963
	86	10	4	2.042/2.551	2.042/2.123	3.030/2.734	3.793/3.438	
	88	10	2		3.033/2.465	3.277/2.988	4.237/3.731	4.388/4.353
	90	10	0	4.500/3.333			5.060/4.239	5.248/5.254
	92	10	2	2.473/2.675	2.909/2.410			
	94	10	4	2.699/2.411	2.508/2.012			
	96	10	6	3.602/2.295	2.439/1.791	3.309/2.358	4.752/2.965	
	98	10	8	2.479/2.233	2.479/1.663			
	100	10	10	1.441/2.192	1.295/1.584		2.479/2.658	3.014/3.345
Mo	88	8	4			2.101/2.716		
	92	8	0	2.634/3.300	3.621/3.119		4.918/4.243	
	94	8	2	2.740/2.643	2.805/2.391	3.243/2.896	3.932/3.632	3.867/4.186

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(Table 4. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^+$	$J = 3^+$	$J = 5^+$	$J = 7^+$	$J = 9^+$
	96	8	4	2.502/2.381	1.978/1.995	2.438/2.565	2.875/3.237	3.916/3.738
	98	8	6	1.881/2.265	1.881/1.774	3.229/2.347	2.571/2.975	
	100	8	8	1.977/2.204	1.607/1.647	2.289/2.200		
	102	8	10		1.246/1.570			
	104	8	12		1.028/1.519	1.476/2.022	2.037/2.579	2.683/3.262
	106	8	14		0.885/1.482	1.307/1.965	1.868/2.507	2.559/3.207
	108	8	16		0.783/1.454	1.232/1.919	1.817/2.449	2.524/3.155
Ru	94	6	0		2.503/3.118	2.503/3.423		
	96	6	2	2.579/2.615	2.525/2.391	2.700/2.912	3.281/3.681	3.172/4.194
	98	6	4	2.375/2.354	1.797/1.996	2.241/2.582	3.538/3.287	4.006/3.748
	100	6	6	2.606/2.240	1.881/1.776	2.325/2.366	3.446/3.027	4.343/3.537
	102	6	8		1.522/1.649	2.219/2.219		
	104	6	10		1.242/1.573	1.872/2.118	1.975/2.727	
	106	6	12	2.239/2.109	1.092/1.522	1.641/2.044	2.284/2.636	
	108	6	14		0.975/1.487	1.496/1.988	2.133/2.566	2.844/3.227
Pd	110	6	16		0.860/1.459	1.375/1.943	2.021/2.509	2.777/3.177
	112	6	14		0.748/1.448	1.236/1.933	1.841/2.494	2.534/3.132
	114	6	12		0.829/1.445	1.373/1.935		
	96	4	0	2.391/3.260	2.391/3.172	3.725/3.503	3.184/4.410	4.711/5.303
	98	4	2			2.564/2.994	3.219/3.803	3.753/4.272
	100	4	4	1.524/2.345	2.359/2.051	2.279/2.665		
	102	4	6	2.391/2.231	2.112/1.832	2.977/2.450		
	104	4	8	1.999/2.172	1.821/1.707	2.445/2.305		
	106	4	10	2.472/2.134	1.558/1.631	2.366/2.204		3.462/3.428
	108	4	12	1.540/2.104	1.335/1.581	2.084/2.131	2.919/2.765	3.280/3.369
	110	4	14	3.232/2.077	1.212/1.546	2.570/2.076		
	112	4	16		1.097/1.519			
	114	4	14		1.012/1.508	1.630/2.023	2.290/2.627	2.906/3.225
	116	4	12		1.066/1.506		2.492/2.626	3.255/3.185
	118	4	10		1.183/1.517	1.856/2.046		
Cd	100	2	2			3.264/3.221		
	102	2	4				2.988/3.659	2.988/4.044
	104	2	6			2.614/2.679	3.844/3.402	4.397/3.837
	106	2	8	2.721/2.238	2.254/1.938	2.331/2.535	3.084/3.229	
	108	2	10	2.683/2.200	2.146/1.863	2.565/2.435	3.190/3.108	
	110	2	12	2.336/2.170	2.163/1.814	2.927/2.363		4.438/3.592
	112	2	14	2.674/2.144	2.065/1.779	2.507/2.309	3.494/2.952	3.914/3.542
	114	2	16	2.505/2.120	1.864/1.753			
	116	2	14	2.478/2.098	1.916/1.743			
	118	2	12	2.789/2.077	1.929/1.741	2.223/2.261		
	122	2	8		1.979/1.791			
	124	2	6	1.978/2.060	1.915/1.879	2.682/2.422		
Sn	106	0	6					
	108	0	8		2.976/2.722	2.625/3.088	3.870/3.697	4.399/4.209
	110	0	10		2.821/2.648	2.821/2.989		
	112	0	12	2.557/2.566	2.756/2.599			
	114	0	14	3.212/2.540	2.515/2.566		4.313/3.424	5.488/4.031
	116	0	16	2.586/2.517	2.996/2.539	3.351/2.823	4.285/3.371	
	118	0	14	2.725/2.495	2.725/2.530	2.879/2.815	3.052/3.359	3.108/3.945
	120	0	12	2.297/2.475	3.210/2.529			
	122	0	10	2.880/2.458	2.945/2.541			
	124	0	8	3.110/2.449	2.837/2.580		3.011/3.436	3.011/3.864
	126	0	6		2.712/2.669			
	128	0	4		2.274/2.850		2.413/3.731	
	130	0	2			2.493/3.420		
	132	0	0			4.885/3.875	4.919/4.588	5.280/5.293
Te	108	2	6				2.997/3.326	3.661/3.735
	110	2	8			1.928/2.479	2.576/3.155	3.224/3.626
	114	2	12	1.342/2.122	1.950/1.776		3.253/2.950	3.723/3.500
	116	2	14	2.081/2.098	1.638/1.743	2.340/2.258	3.245/2.885	
	118	2	16	1.482/2.074	1.892/1.717	2.368/2.217	2.919/2.833	3.400/3.409
	120	2	14		1.863/1.708			
	122	2	12	2.204/2.034	1.952/1.707	2.536/2.215		3.211/3.334
	124	2	10	2.530/2.017	2.039/1.720	2.534/2.237	2.674/2.847	3.291/3.305

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(Table 4. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^+$	$J = 3^+$	$J = 5^+$	$J = 7^+$	$J = 9^+$
	126	2	8	2.181/2.009	2.128/1.760	2.661/2.286	3.194/2.902	3.194/3.292
	128	2	6	1.969/2.021	1.969/1.849	2.270/2.379		
	130	2	4	2.607/2.086	2.139/2.030	2.719/2.543		
	132	2	2		2.108/2.387			
	134	2	0	2.632/2.905	2.683/3.075	2.727/3.274		5.079/4.725
	136	2	2	1.905/2.262				
Xe	116	4	12		1.474/1.506	2.086/2.026		3.555/3.185
	118	4	14		1.366/1.473	1.922/1.974	2.560/2.562	3.240/3.139
	120	4	16	1.982/1.961	1.272/1.448	1.817/1.933	2.461/2.511	3.174/3.096
	122	4	14	1.716/1.940	1.214/1.440	1.775/1.928	2.459/2.501	3.216/3.058
	124	4	12	2.182/1.921	1.248/1.439	1.837/1.933	2.575/2.504	3.344/3.023
	126	4	10	2.229/1.905	1.318/1.453	1.903/1.955	2.661/2.528	3.384/2.996
	128	4	8	2.127/1.897	1.430/1.492	1.997/2.005	2.731/2.584	2.942/2.984
	130	4	6	2.296/1.909	1.633/1.582	2.172/2.099		3.278/3.010
	132	4	4	2.169/1.976	1.804/1.764	2.167/2.263	2.828/2.882	
	134	4	2	2.389/2.188	1.920/2.121	2.272/2.539		
	136	4	0		2.126/2.809	2.444/2.996		
	138	4	2	1.866/2.153	1.903/2.094			
Ba	122	6	16		1.168/1.352	1.604/1.794	2.142/2.314	2.767/2.919
	124	6	14		1.162/1.344	1.672/1.789	2.295/2.305	2.975/2.882
	126	6	12	1.936/1.881	1.236/1.344	1.808/1.795	2.485/2.308	3.096/2.848
	128	6	10	2.347/1.865	1.324/1.358	1.931/1.818	2.631/2.333	3.387/2.821
	130	6	8	2.734/1.858	1.361/1.399	2.013/1.869		
	132	6	6	2.878/1.871	1.511/1.488	2.226/1.963	2.934/2.498	3.505/2.837
	134	6	4	2.311/1.937	1.643/1.671	2.285/2.128		
	136	6	2	2.392/2.150	2.431/2.028	2.374/2.405		
	138	6	0	2.190/2.757	2.446/2.716	2.415/2.862	3.360/3.551	4.158/4.251
	140	6	2	2.310/2.116	1.952/2.002			
	142	6	4	2.342/1.869	1.292/1.618	1.747/2.056	2.070/2.596	2.680/2.833
	144	6	6	0.759/1.768		1.881/1.855	2.159/2.357	1.773/2.650
	146	6	8	0.739/1.721				
Ce	126	8	14		1.155/1.304			
	128	8	12		1.052/1.304	1.663/1.722	2.298/2.185	3.001/2.742
	130	8	10		1.177/1.319			
	132	8	8		1.199/1.359	1.815/1.797		
	134	8	6	1.904/1.848	1.383/1.449	2.050/1.892	2.769/2.377	3.073/2.734
	136	8	4	2.067/1.915	1.553/1.632			
	138	8	2	2.237/2.128	2.177/1.990	2.471/2.334	3.430/2.894	2.526/3.210
	140	8	0	2.547/2.736	2.412/2.679	2.350/2.792	3.433/3.432	3.895/4.150
	142	8	2	2.398/2.095	2.182/1.965	2.570/2.299		
	144	8	4	1.346/1.849	1.692/1.581	1.891/1.987		
	146	8	6		1.577/1.373	1.810/1.787		
	148	8	8	1.497/1.701	1.117/1.257	1.423/1.656	1.787/2.085	2.199/2.463
Nd	132	10	10		1.118/1.297			
	134	10	8		1.089/1.338	1.698/1.755		
	136	10	6		1.231/1.428	2.046/1.850		
	138	10	4	2.273/1.897	1.452/1.611			
	140	10	2		2.124/1.969		2.842/2.815	3.419/3.143
	142	10	0	2.586/2.719	2.547/2.658	2.514/2.752	3.520/3.354	4.243/4.084
	144	10	2	2.464/2.078	2.179/1.945	2.420/2.259		3.234/3.084
	146	10	4	2.149/1.832	1.777/1.561	2.046/1.947		
	148	10	6	1.521/1.732	1.512/1.353	1.688/1.748		
	150	10	8	1.182/1.685	1.201/1.238			
	152	10	10		1.600/1.172	1.773/1.531		
	154	10	12	0.962/1.641	1.028/1.132			
Sm	138	12	6		1.084/1.412	1.733/1.822	2.501/2.242	
	140	12	4	1.420/1.880		2.015/1.988	2.326/2.435	2.128/2.739
	142	12	2					
	144	12	0	2.645/2.702	2.688/2.644	2.707/2.724	3.079/3.300	
	146	12	2		2.270/1.930	2.898/2.233		3.567/3.038
	148	12	4	1.461/1.817	1.659/1.547	2.147/1.921	2.392/2.348	3.095/2.624
	150	12	6	1.713/1.717	1.504/1.340	1.883/1.722		
	152	12	8	1.290/1.671	1.234/1.225	1.560/1.592	1.946/1.957	2.375/2.356

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(Table 4. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^+$	$J = 3^+$	$J = 5^+$	$J = 7^+$	$J = 9^+$
Gd	154	12	10	2.140/1.645	1.539/1.159	1.805/1.506	2.154/1.855	
	140	14	6		1.068/1.399	1.693/1.799	2.411/2.200	3.034/2.576
	142	14	4	0.980/1.864				
	144	14	2	2.462/2.078				
	146	14	0		3.031/2.631	3.287/2.703		4.248/4.000
	148	14	2	3.131/2.047	1.835/1.918	2.869/2.212	2.935/2.679	3.478/3.001
	150	14	4	1.592/1.802	1.988/1.535		2.392/2.310	
	152	14	6	1.461/1.702	1.434/1.328	1.862/1.702	2.302/2.074	2.537/2.408
	154	14	8	1.510/1.656	1.128/1.213	1.433/1.573	1.810/1.920	2.272/2.321
	156	14	10	1.966/1.631	1.248/1.147	1.507/1.487	1.850/1.818	2.250/2.272
	158	14	12	1.848/1.613	1.266/1.108	1.481/1.429		
	160	14	14	1.351/1.598	1.058/1.082	1.193/1.387	1.549/1.697	
	162	14	16		0.930/1.064			
Dy	146	16	2					
	150	16	2				2.583/2.648	3.243/2.969
	152	16	4	1.453/1.787			2.297/2.280	3.244/2.557
	154	16	6		1.334/1.317	1.740/1.685	2.183/2.044	
	156	16	8		1.022/1.202	1.336/1.556	1.729/1.891	2.192/2.291
	158	16	10	1.976/1.617	1.045/1.137	1.315/1.471	1.676/1.789	
	160	16	12	1.557/1.599	1.049/1.097	1.289/1.413	1.617/1.719	2.022/2.209
	162	16	14	1.746/1.584	0.963/1.072	1.183/1.372	1.490/1.669	1.878/2.182
	164	16	16	1.738/1.571	0.828/1.054	1.932/1.341	1.303/1.632	1.655/2.157
Er	166	16	18	2.070/1.558	0.929/1.040	1.141/1.318		
	156	14	6		1.243/1.306	1.663/1.672		
	158	14	8	1.630/1.628	1.043/1.192	1.438/1.544	1.913/1.883	
	160	14	10	1.536/1.603	0.987/1.127		1.743/1.781	2.150/2.223
	162	14	12	1.413/1.586	1.002/1.088	1.286/1.401	1.669/1.712	2.134/2.190
	164	14	14	1.862/1.571	0.946/1.063	1.197/1.360	1.545/1.662	1.977/2.164
	166	14	16	1.813/1.558	0.859/1.045	1.075/1.330	1.376/1.626	1.751/2.140
	168	14	18	2.134/1.546	0.896/1.031	1.118/1.307	1.433/1.597	
	170	14	20	1.501/1.533	1.011/1.020	1.237/1.288	1.557/1.573	1.964/2.096
Yb	172	14	22	0.961/1.521	1.263/1.010			
	160	12	8	1.496/1.615	1.113/1.182			2.702/2.257
	162	12	10	1.398/1.590	0.992/1.118		1.573/1.782	
	164	12	12	1.336/1.573	1.004/1.079	1.348/1.392	1.780/1.713	2.272/2.177
	166	12	14	1.923/1.559	1.039/1.054	1.328/1.352	1.705/1.664	2.150/2.151
	168	12	16		1.067/1.036	1.302/1.322	1.619/1.628	2.002/2.127
	170	12	18		1.225/1.023	1.460/1.299	1.835/1.599	2.170/2.105
	172	12	20	2.010/1.522	1.172/1.012	1.376/1.280	1.666/1.576	2.039/2.084
	174	12	22	1.624/1.510	1.606/1.002	1.820/1.264	1.671/1.556	
Hf	176	12	20	1.819/1.498	1.336/0.994	1.492/1.257		
	164	10	10		1.073/1.110			
	166	10	12		1.007/1.072	1.419/1.390		
	168	10	14		1.031/1.047			
	170	10	16		1.088/1.030			
	172	10	18		1.181/1.016	1.031/1.297	1.677/1.615	1.739/2.102
	174	10	20		1.303/1.005	1.508/1.279	1.737/1.592	2.167/2.082
	176	10	22	1.863/1.499	1.446/0.996	1.728/1.263	1.506/1.572	1.914/2.062
	178	10	20	1.942/1.487	1.269/0.988	1.533/1.256	1.742/1.563	2.183/2.042
W	180	10	18	2.378/1.476	1.291/0.982	1.193/1.251	1.895/1.556	
	182	10	16	0.818/1.466				
	170	8	14		1.074/1.046	1.719/1.360		
	176	8	20		1.179/1.005	1.518/1.290	1.858/1.632	2.150/2.097
	178	8	22		1.237/0.995	1.572/1.275	1.835/1.613	2.227/2.078
	180	8	20		1.633/0.988	1.568/1.267	1.912/1.603	2.274/2.059
	182	8	18	2.382/1.467	1.331/0.982	1.624/1.263	1.971/1.597	2.480/2.040
	184	8	16	1.615/1.456	1.006/0.978	1.295/1.263		
	186	8	14	1.279/1.446	0.862/0.979			
Os	188	8	12	0.854/1.438	0.854/0.986	1.538/1.286		
	172	6	14		1.108/1.061	1.605/1.400	1.978/1.799	
	174	6	16		1.054/1.045	1.453/1.371		2.410/2.188

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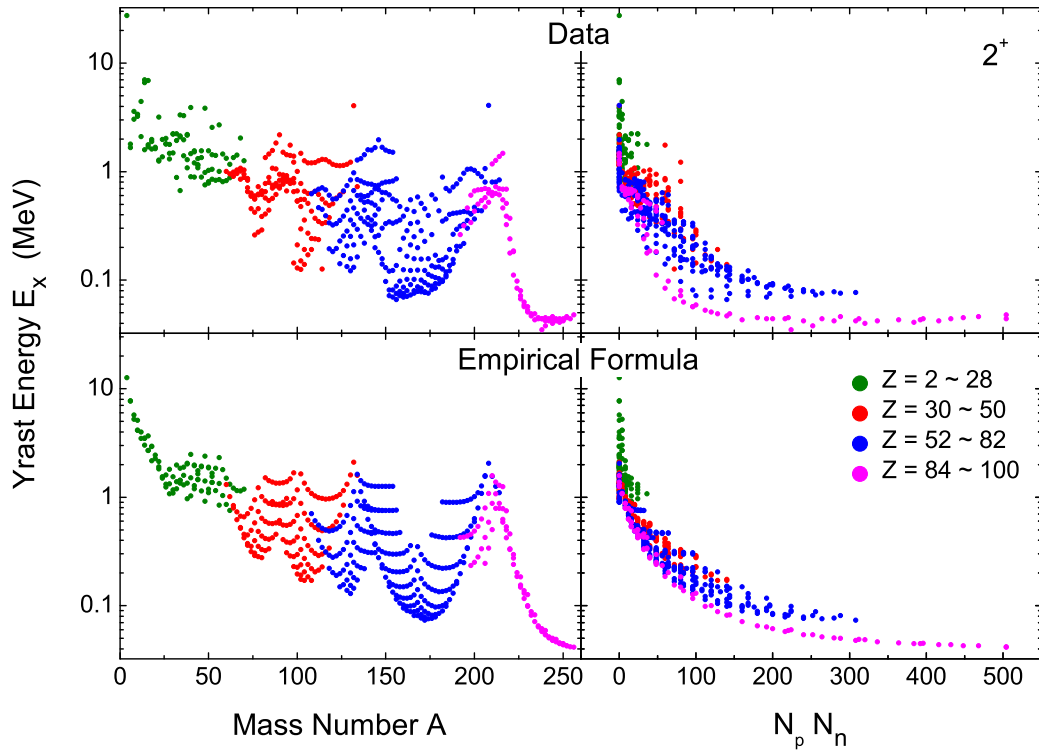
(Table 4. continued)

Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^+$	$J = 3^+$	$J = 5^+$	$J = 7^+$	$J = 9^+$
	176	6	18		1.038/1.032	1.410/1.349	1.979/1.736	2.265/2.168
	178	6	20		1.032/1.021	1.416/1.330	2.097/1.714	2.465/2.148
	180	6	22		1.023/1.011	1.406/1.315	1.881/1.695	2.411/2.129
	182	6	20		1.039/1.005	1.399/1.308	1.853/1.685	2.245/2.110
	184	6	18		1.081/0.999	1.428/1.304		2.366/2.092
	186	6	16		0.910/0.995	1.276/1.304	1.751/1.678	2.317/2.074
	188	6	14	1.843/1.440	0.790/0.996	1.181/1.311	1.686/1.685	
	190	6	12	1.116/1.432	0.756/1.004	1.204/1.328		
	192	6	10	1.665/1.426	0.690/1.025	1.144/1.362	1.713/1.743	
Pt	178	4	18		1.001/1.102			
	180	4	20		0.963/1.092	1.315/1.435	1.727/1.867	2.107/2.267
	182	4	22	1.054/1.491	0.942/1.083	1.304/1.420	1.730/1.848	
	184	4	20		1.028/1.076	1.463/1.414	1.630/1.839	
	186	4	18		0.957/1.070	1.363/1.410	1.801/1.833	2.280/2.212
	188	4	16	1.626/1.460	0.936/1.067		1.769/1.832	2.621/2.195
	190	4	14	1.602/1.451	0.917/1.068	1.450/1.417	2.044/1.839	
	192	4	12	1.133/1.442	0.921/1.076	1.482/1.434	2.113/1.859	
	194	4	10	1.584/1.437	0.923/1.097	1.499/1.469	1.984/1.898	2.310/2.159
	196	4	8	1.802/1.439	1.015/1.145	1.902/1.530		
Hg	198	4	6		1.248/1.242			
	200	4	4		1.181/1.432			
	182	2	20			1.770/1.684	2.009/2.144	2.325/2.520
	184	2	22	0.983/1.573				
	186	2	20		1.434/1.320	1.870/1.663		2.574/2.483
	188	2	18		1.455/1.315	1.908/1.659		
	190	2	16		1.657/1.312	2.073/1.659		
	192	2	14	1.909/1.533	1.535/1.313			
	194	2	12	1.958/1.525	1.468/1.321			
	196	2	10	0.958/1.519	1.391/1.343			
Pb	198	2	8	1.548/1.521	1.847/1.391			
	200	2	6	1.570/1.544	1.659/1.488		2.377/2.371	2.597/2.468
	202	2	4	1.348/1.619	1.562/1.677			
	204	2	2	1.841/1.841	2.141/2.042	2.724/2.346	2.724/2.913	2.724/2.977
	188	0	20			1.789/2.234	2.218/2.609	
	192	0	16	1.544/1.952				2.790/2.967
	194	0	14	1.637/1.943	1.637/2.110	2.408/2.238	2.799/2.611	2.931/2.952
	196	0	12		1.826/2.118	2.376/2.256		
	198	0	10			1.996/2.291		
	200	0	8	1.739/1.932		1.762/2.353		
Po	202	0	6		2.185/2.286	2.325/2.458		
	204	0	4	1.681/2.030	1.605/2.475	2.065/2.633		
	206	0	2	1.704/2.252	2.197/2.840	4.717/2.919	4.939/3.407	5.011/3.497
	208	0	0	4.144/2.868	5.317/3.535	4.962/3.386	4.868/3.958	4.144/4.453
	200	2	10	1.652/1.501	1.652/1.329	1.773/1.700	2.338/2.153	2.338/2.382
	202	2	8		1.585/1.377	1.774/1.762	2.295/2.225	2.295/2.391
	204	2	6		1.634/1.474		2.376/2.348	2.539/2.437
	206	2	4	3.362/1.602	1.565/1.664	2.101/2.042	3.362/2.553	2.423/2.576
	208	2	2		1.420/2.029	2.149/2.329	2.335/2.890	2.241/2.947
	210	2	0	2.394/2.439	2.414/2.724	2.403/2.796	2.438/3.441	
Rn	212	2	2	1.621/1.806				
	214	2	4	1.765/1.568	1.713/1.639			
	200	4	12					2.301/2.101
	202	4	10	1.030/1.399	1.030/1.070			
	206	4	6		1.502/1.215		2.207/2.046	
	208	4	4			1.578/1.774	2.129/2.251	
Ra	214	4	2					2.377/2.633
	216	4	4					1.838/2.233
	222	6	8	1.172/1.307	1.265/0.984			
	224	6	10	1.379/1.288	1.348/0.923			
	226	6	12	1.423/1.276				
	228	6	14	1.042/1.267	0.899/0.868			

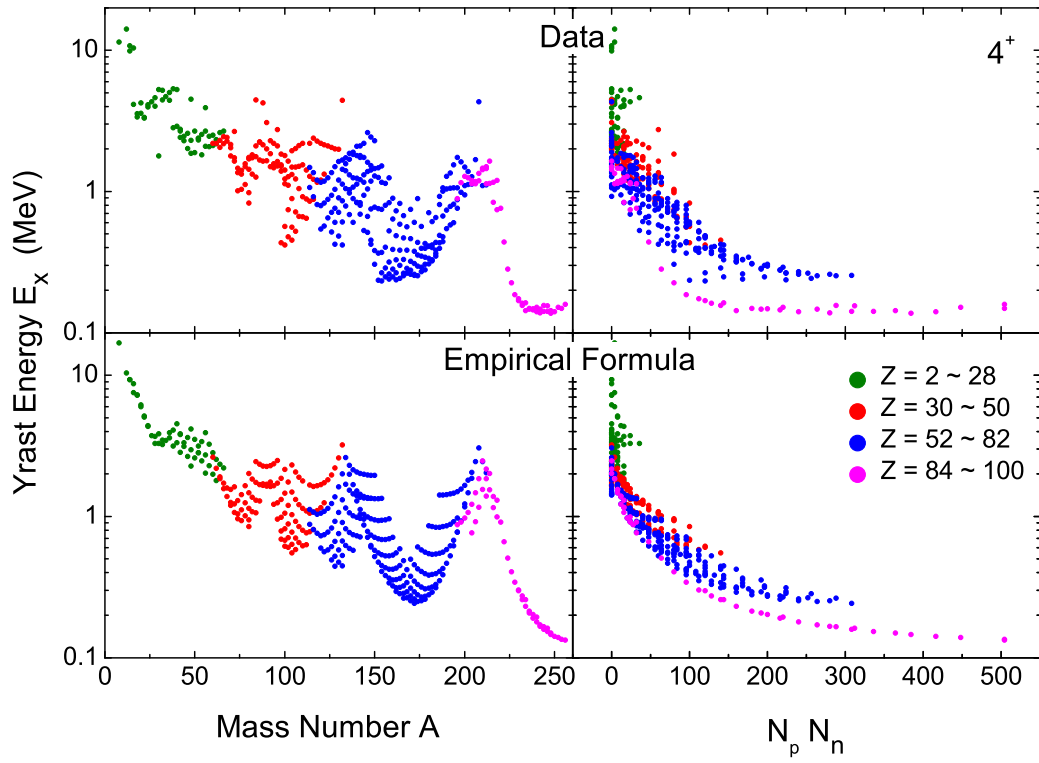
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(Table 4. continued)

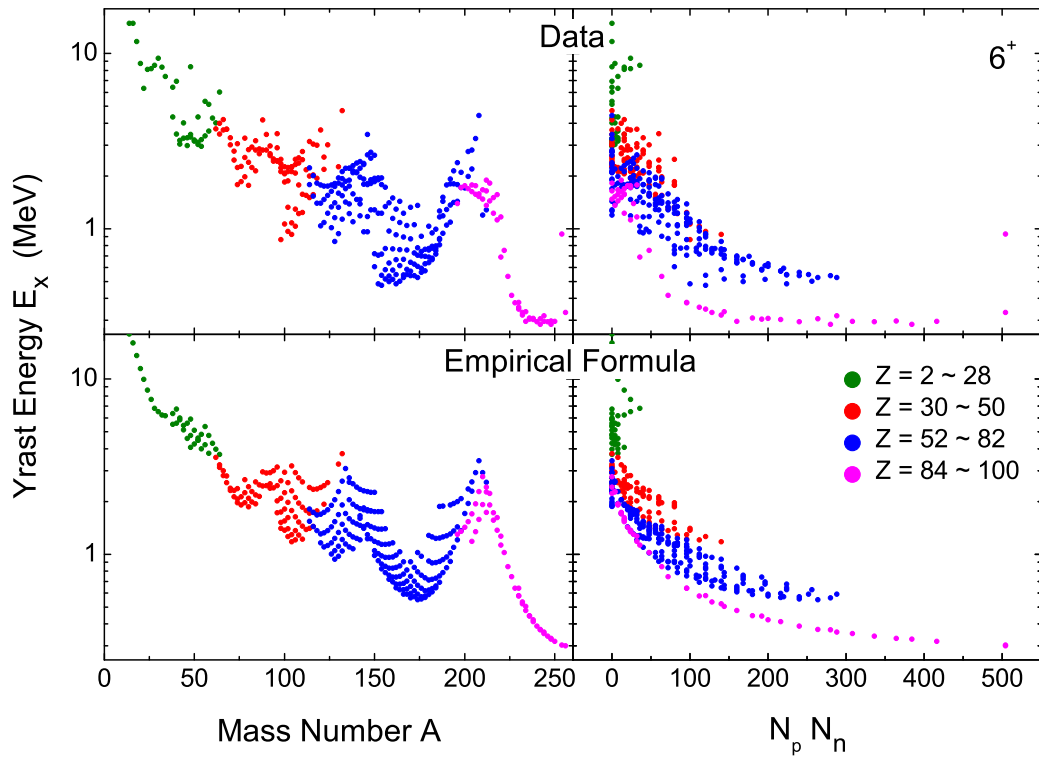
Nuclide	A	N_p	N_n	E_x (MeV)				
				$J = 1^+$	$J = 3^+$	$J = 5^+$	$J = 7^+$	$J = 9^+$
Th	230	6	16		0.786/0.854	0.932/1.115		
	232	6	18		0.849/0.845	0.849/1.097		
	228	8	12	0.944/1.264	1.023/0.858	1.175/1.114		
	230	8	14		0.826/0.838	0.955/1.080	1.134/1.361	1.358/1.684
	232	8	16	2.043/1.248	0.830/0.824	0.960/1.056	1.146/1.332	1.370/1.670
U	234	8	18	1.896/1.240				
	232	10	14		0.911/0.825			
	234	10	16	1.571/1.240	0.968/0.811	1.091/1.026	1.262/1.268	1.891/1.623
	236	10	18	1.791/1.232	1.002/0.802	1.094/1.008		
Pu	238	10	20	2.176/1.225	1.060/0.795	1.232/0.995	1.403/1.231	1.619/1.599
	238	12	18	1.310/1.225	1.070/0.794			
	240	12	20	1.321/1.218	1.031/0.787			
	242	12	22	1.039/1.212				
Cm	244	14	22	1.084/1.205				
	246	14	24	1.452/1.198	1.165/0.770			
Cf	250	16	26	1.386/1.186	1.071/0.760			
	252	16	28		0.846/0.755			
Fm	254	18	28		0.734/0.751			
	256	18	30		0.726/0.746	0.854/0.911		



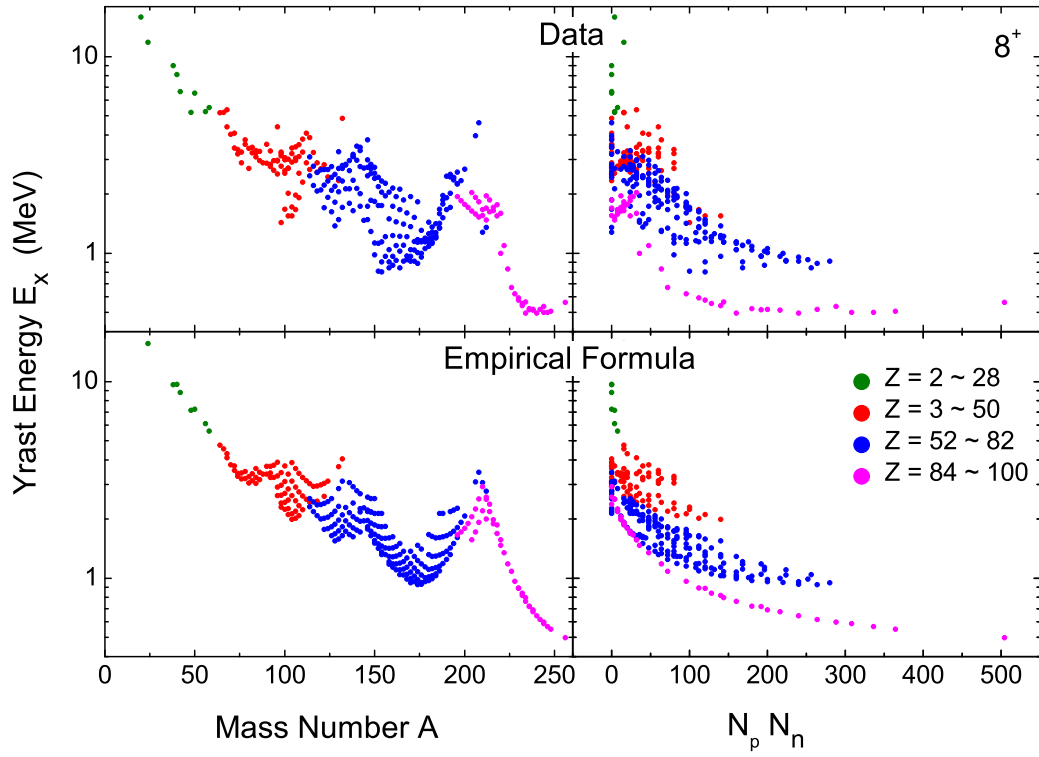
Graph 1. 2^+ yrast energies in even-even nuclei.



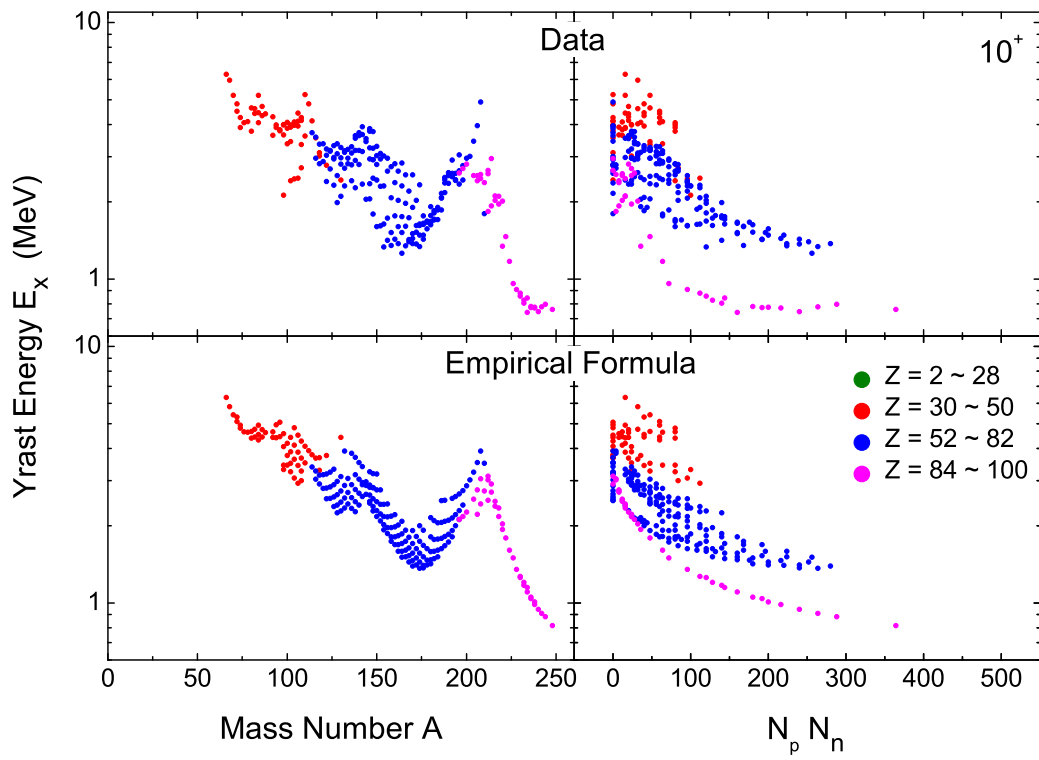
Graph 2. 4^+ yrast energies in even-even nuclei.



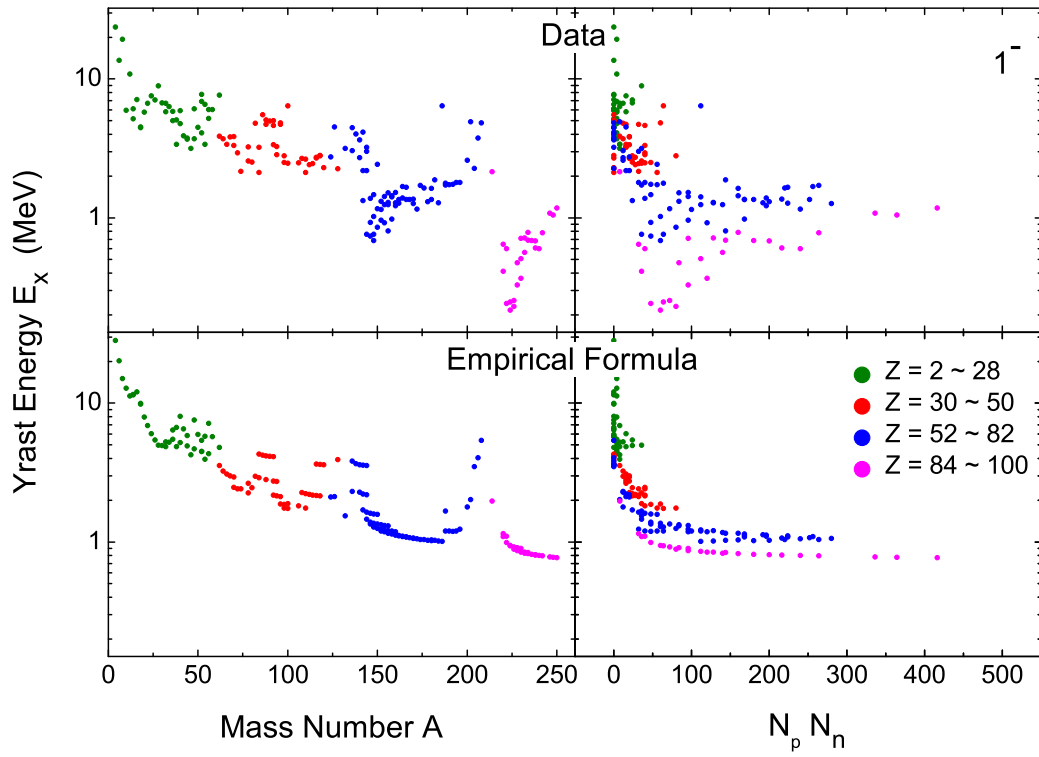
Graph 3. 6^+ yrast energies in even-even nuclei.



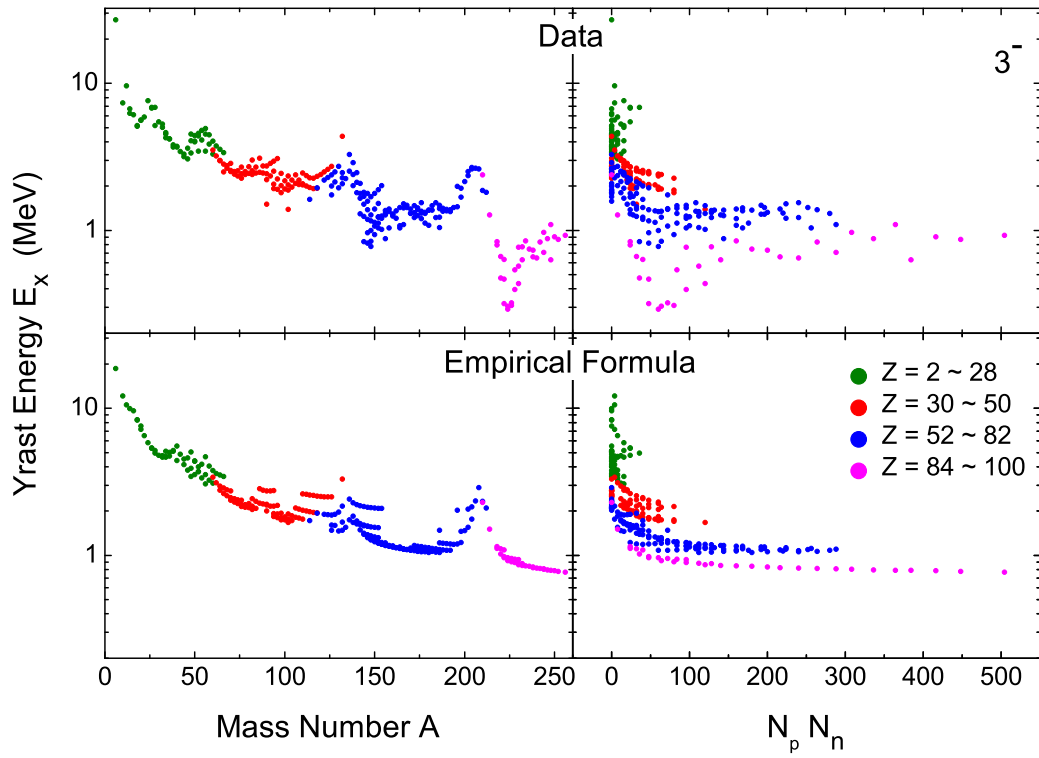
Graph 4. 8^+ yrast energies in even-even nuclei.



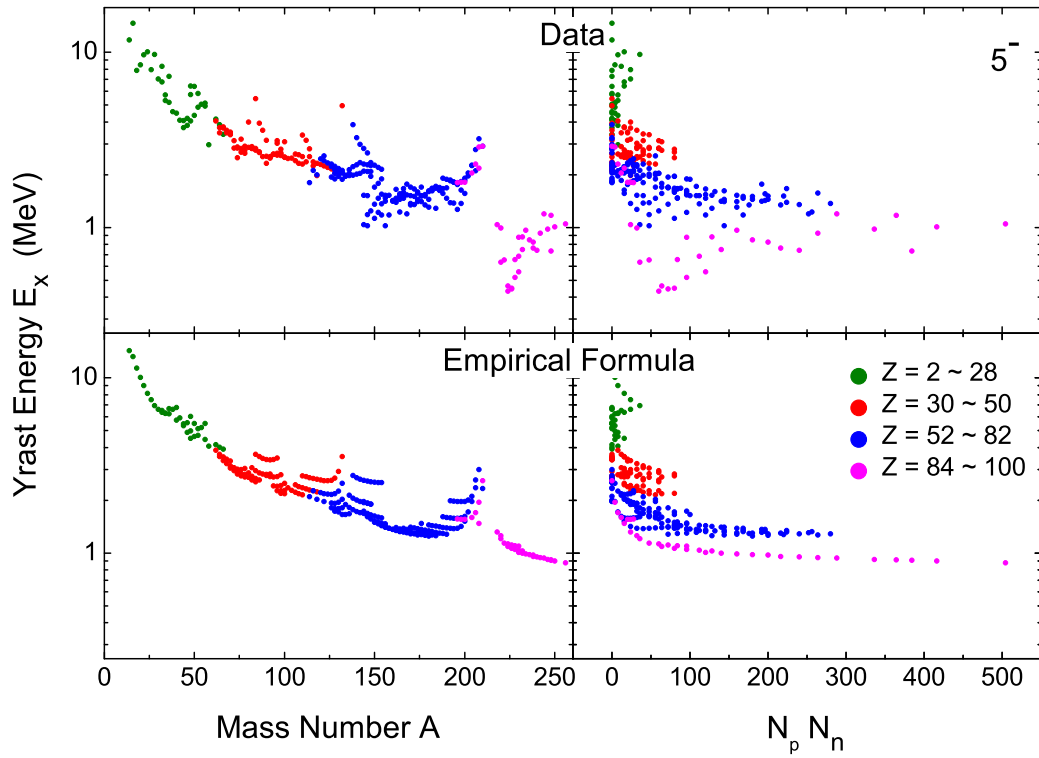
Graph 5. 10^+ yrast energies in even-even nuclei.



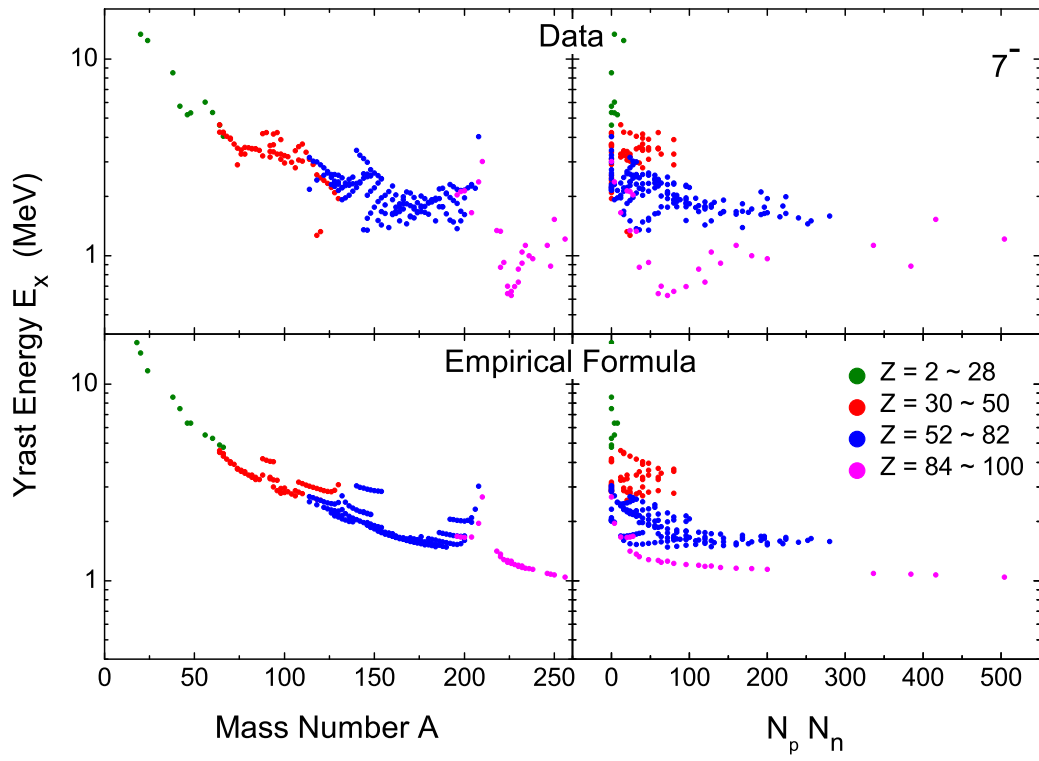
Graph 6. 1^- yrast energies in even-even nuclei.



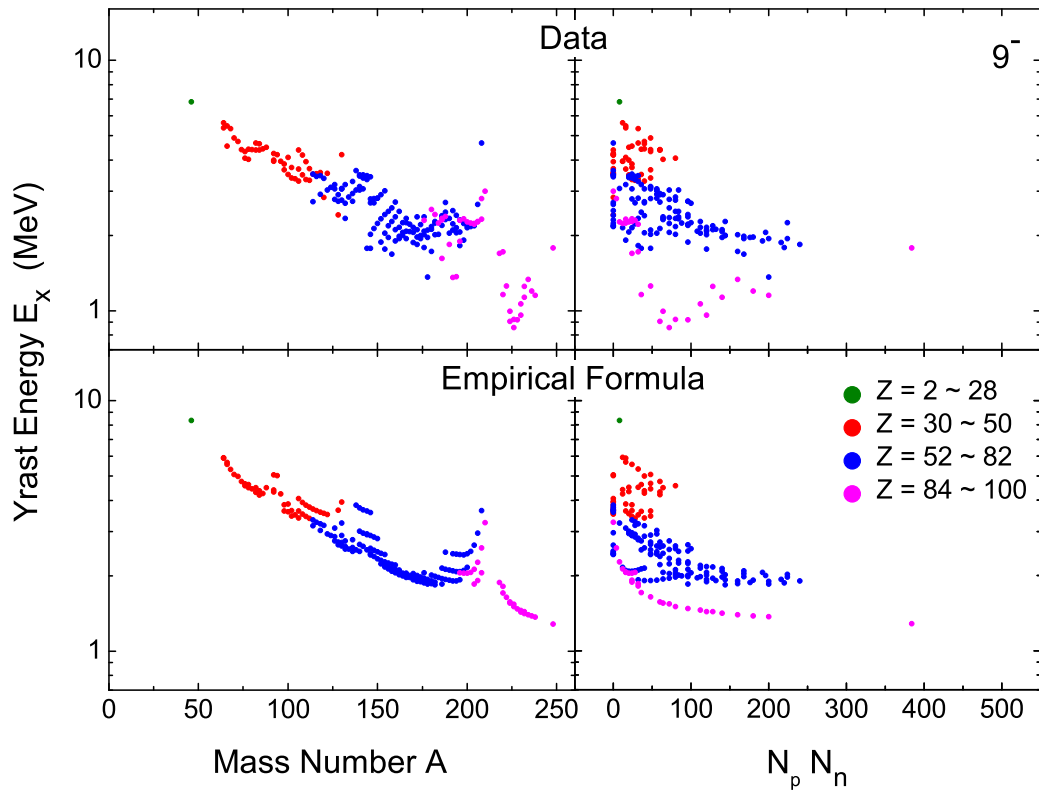
Graph 7. 3^- yrast energies in even-even nuclei.



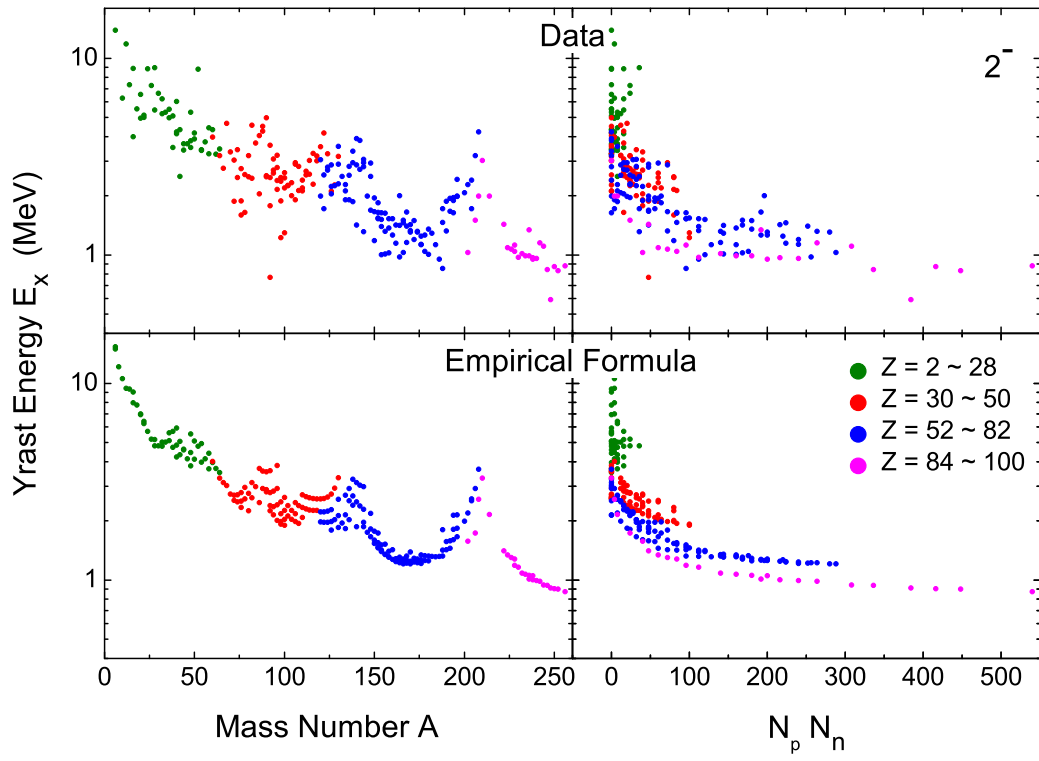
Graph 8. 5^- yrast energies in even-even nuclei.



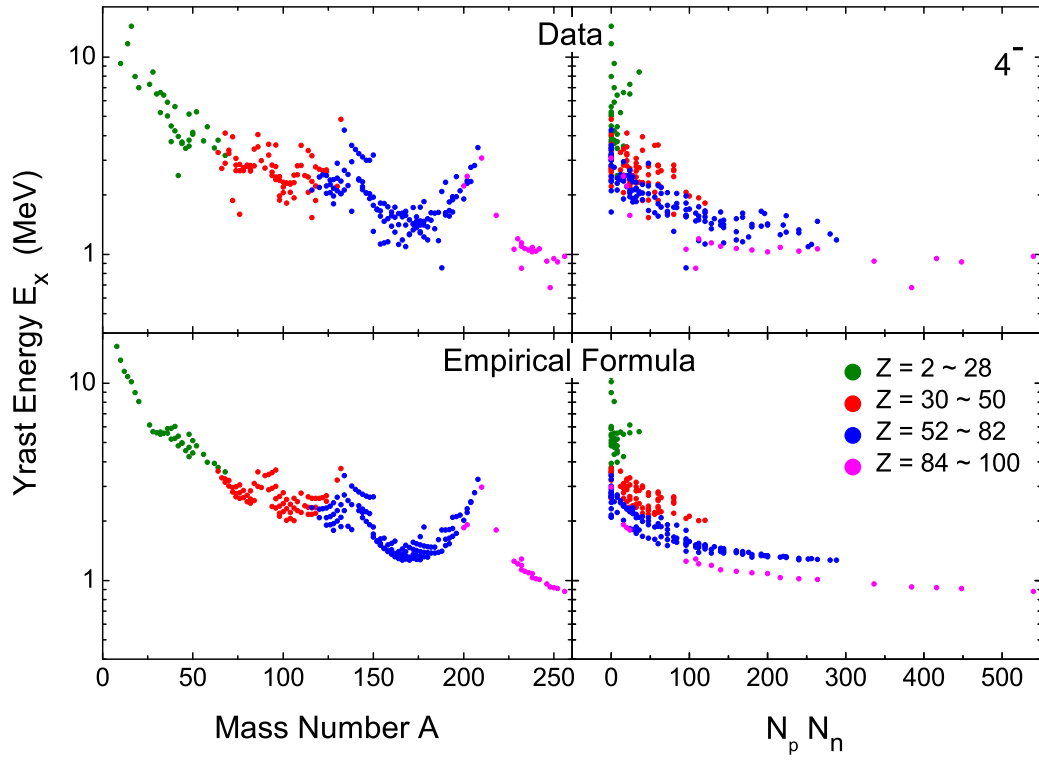
Graph 9. 7^- yrast energies in even-even nuclei.



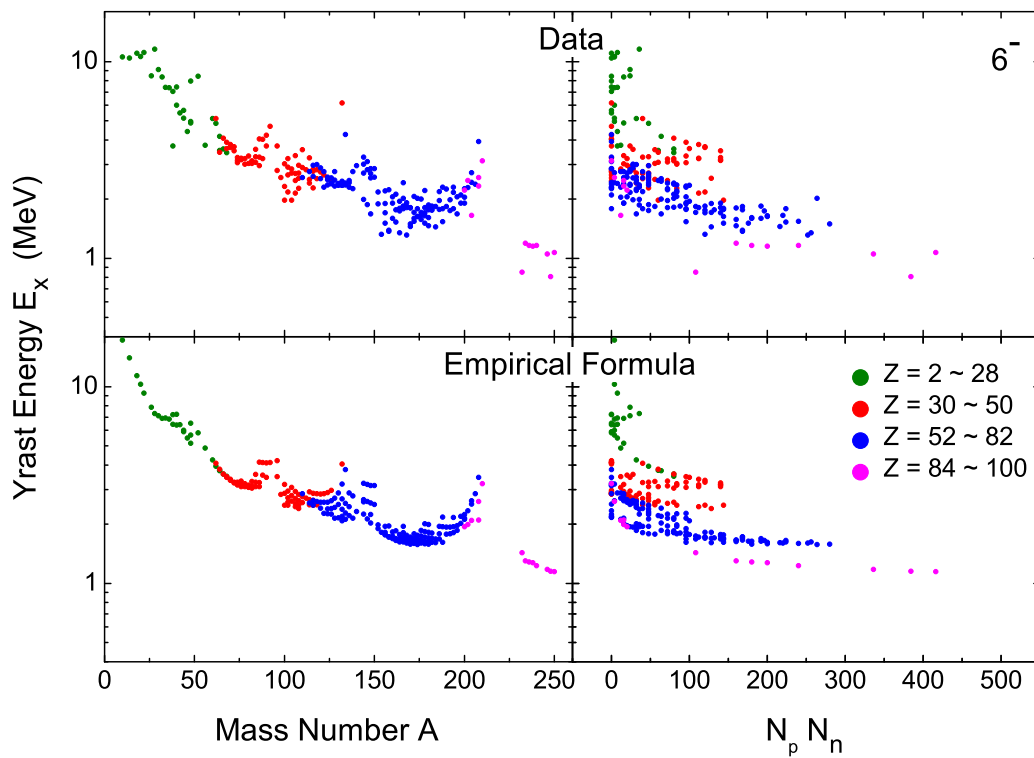
Graph 10. 9^- yrast energies in even-even nuclei.



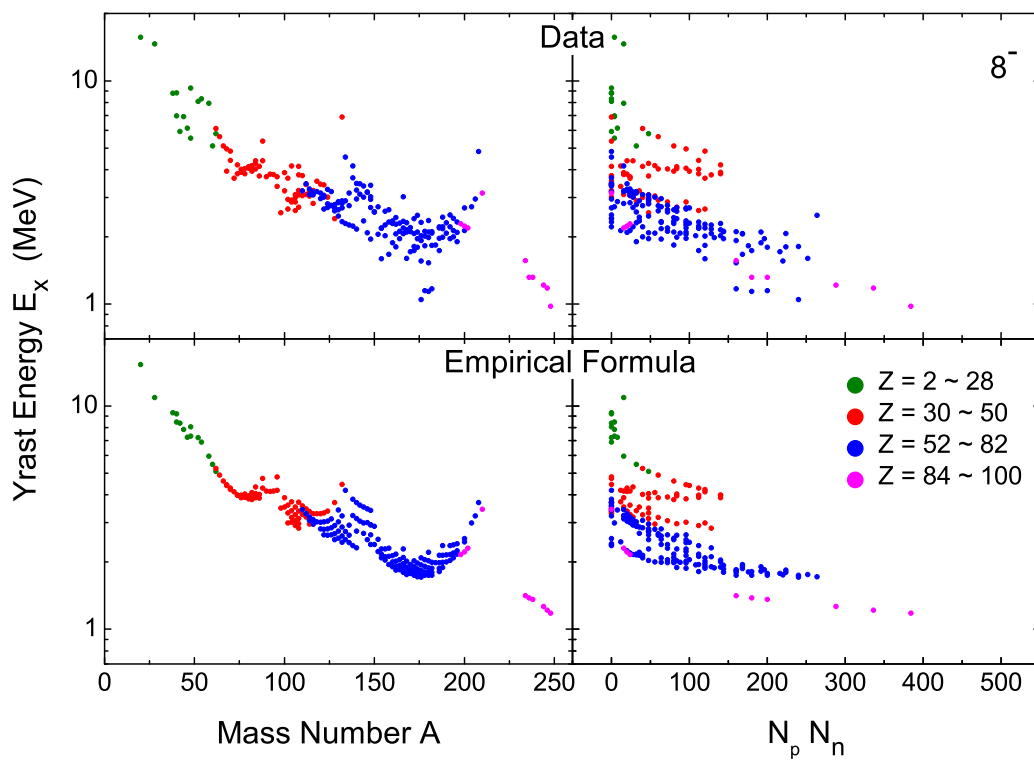
Graph 11. 2^- yrast energies in even-even nuclei.



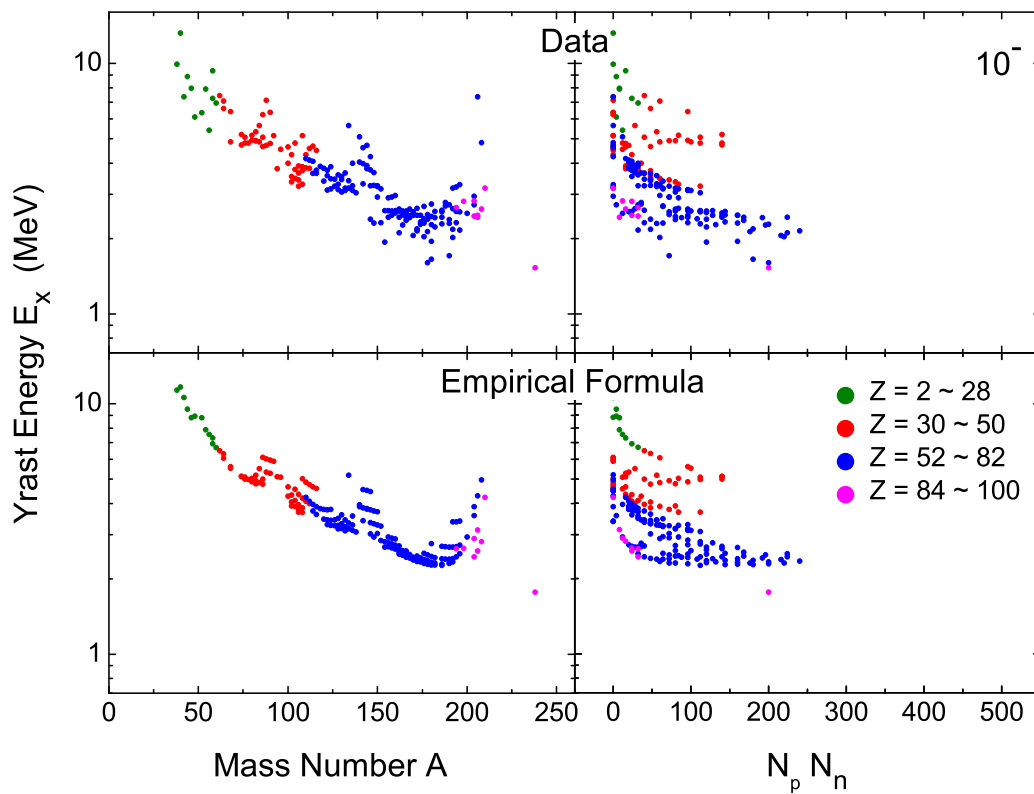
Graph 12. 4^- yrast energies in even-even nuclei.



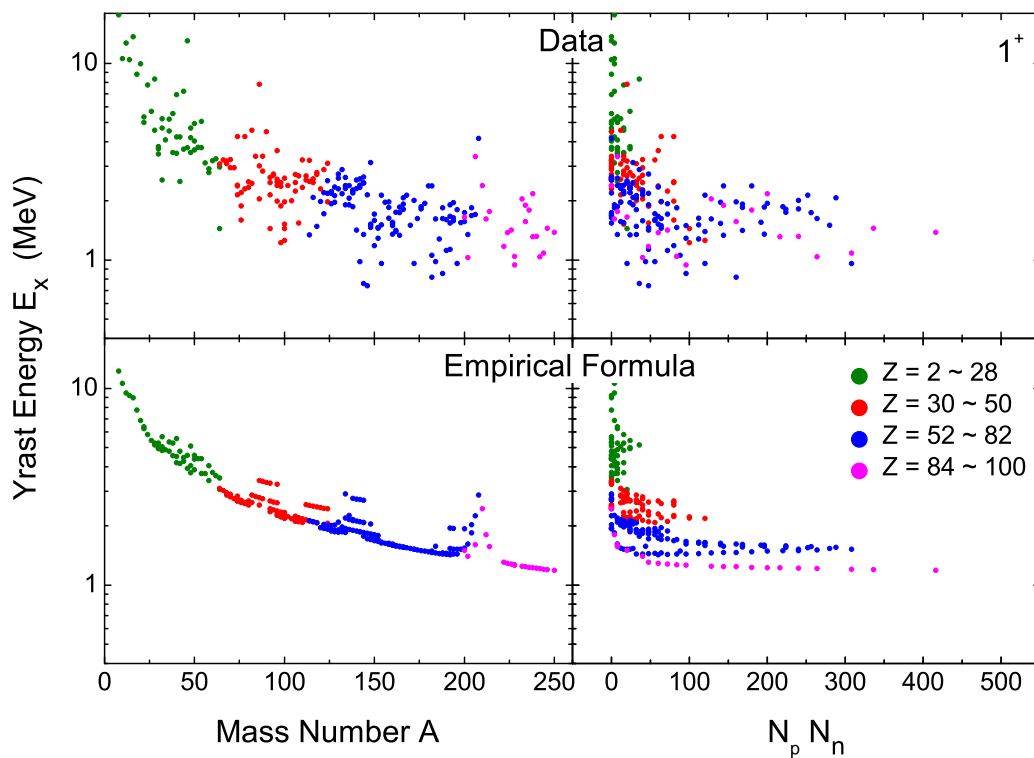
Graph 13. 6^- yrast energies in even-even nuclei.



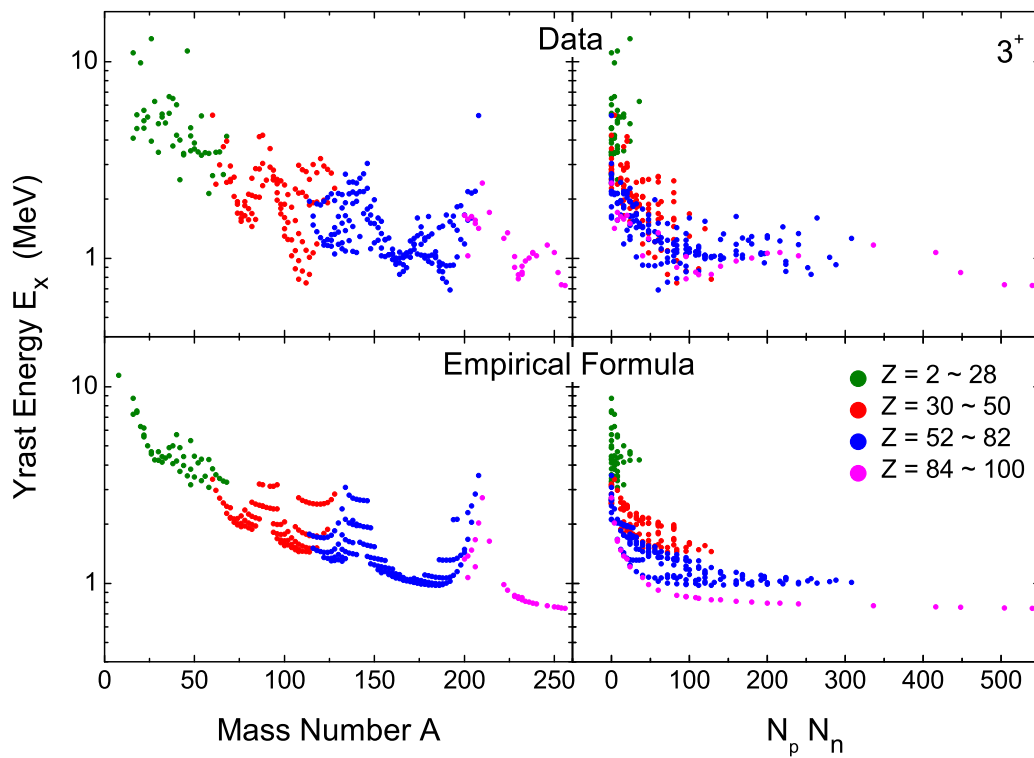
Graph 14. 8^- yrast energies in even-even nuclei.



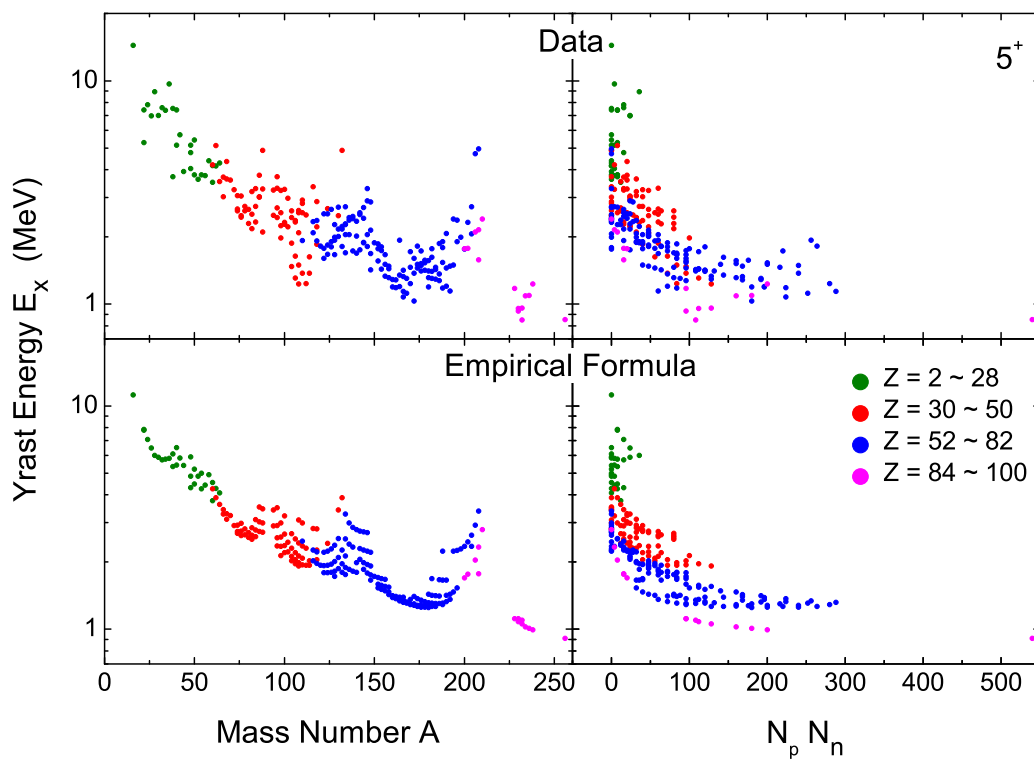
Graph 15. 10^- yrast energies in even-even nuclei.



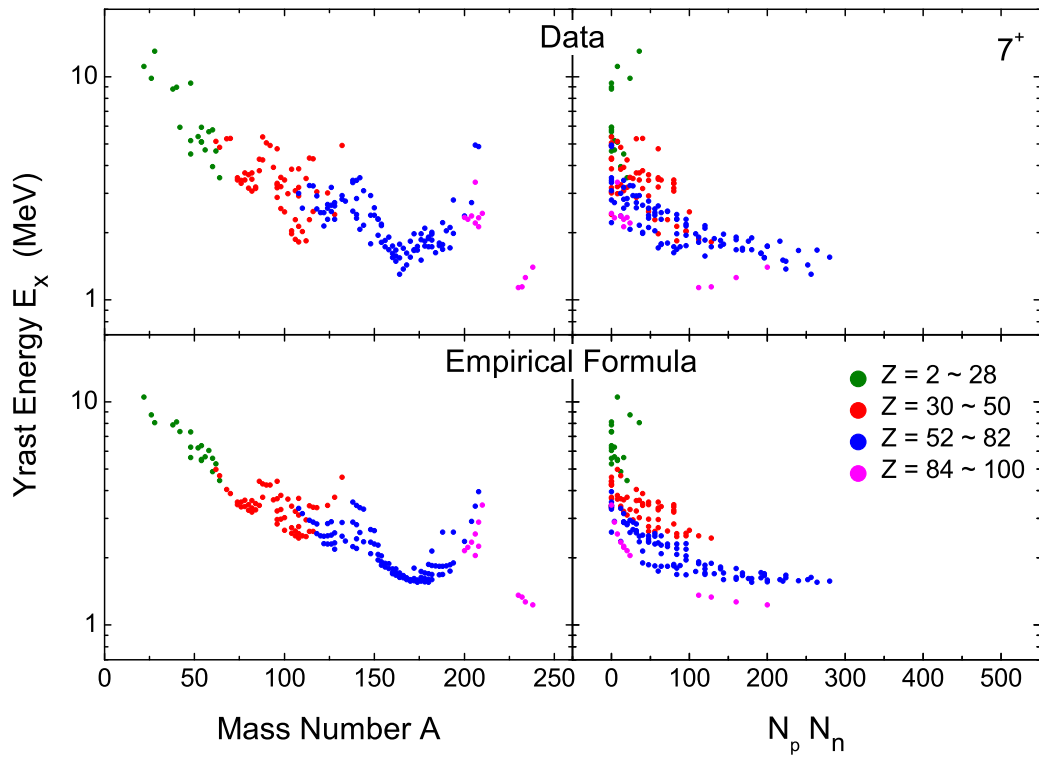
Graph 16. 1^+ yrast energies in even-even nuclei.



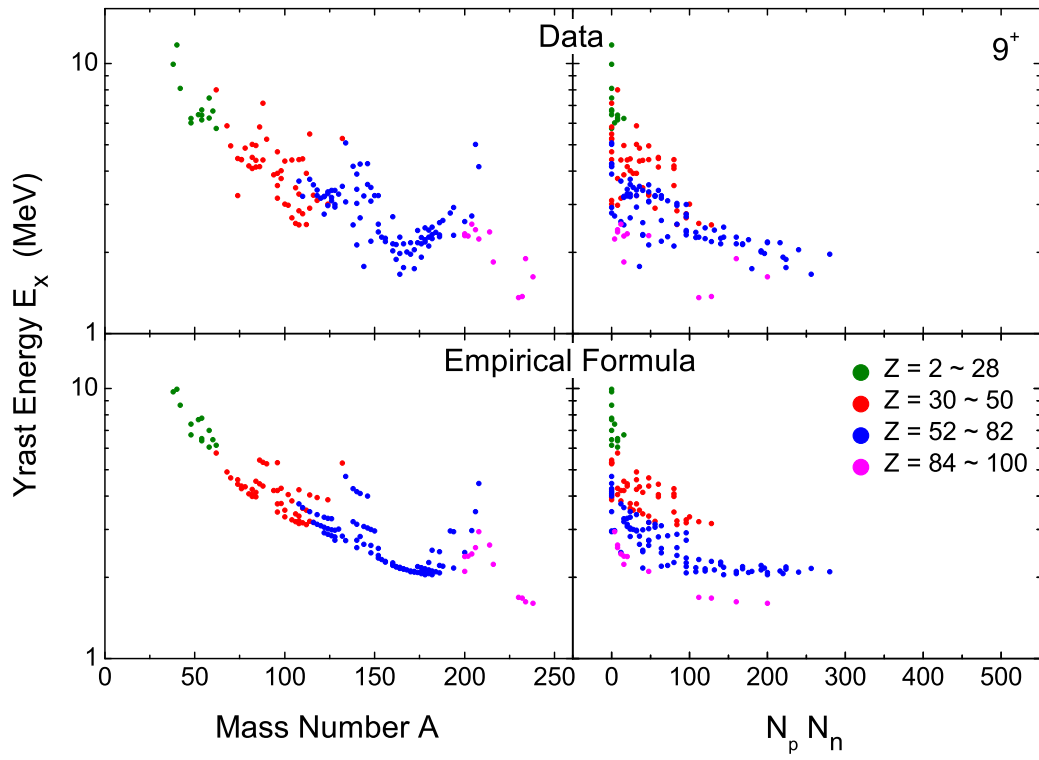
Graph 17. 3^+ yrast energies in even-even nuclei.



Graph 18. 5^+ yrast energies in even-even nuclei.



Graph 19. 7^+ yrast energies in even-even nuclei.



Graph 20. 9^+ yrast energies in even-even nuclei.